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## **Soviet Union**

### ***FOREIGN MILITARY REVIEW***

No 12, December 1988

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# Soviet Union

## FOREIGN MILITARY REVIEW

### No 12, DECEMBER 1988

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[The following are translations of selected articles from the Russian-language monthly journal ZARUBEZHNOYE VOYENNOYE OBOZRENIYE published in Moscow by the Ministry of Defense. Refer to the table of contents for a listing of any articles not translated]

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## FOREIGN MILITARY REVIEW

No 12, December 1988

### Ideological Staunchness of Soviet Military Personnel

18010378a Moscow ZARUBEZHNOYE VOYENNOYE  
OBOZRENIYE in Russian No 12, Dec 1988 (signed to  
press 7 Dec 88) pp 3-6

[Unattributed article under rubric "Toward the 71st Anniversary of the Soviet Army and Navy"]

[Text] The concept of new political thinking is becoming more and more widespread in the world. Advanced by our country as a realistic approach to resolving international problems, it has become a basis for the development of positive processes on the planet. A special place among these processes is held by the Soviet-American dialogue, which outlined a fundamental breakthrough in the sphere of disarmament and so is rightly regarded as one of the principal distinguishing features of modern times. The natural result of this dialogue was the INF Treaty, which was a sign of the profound changes occurring in the sphere of reduction of deadly arms. Among other world processes taking place under the influence of the new approach are steps aimed at fulfilling the Geneva Agreements on Afghanistan, talks on a peaceful settlement of the Iran-Iraq War and talks to relieve conflict situations in Central America, South Africa and the continental Asiatic-Pacific region.

All this does not signify, however, that imperialist sources of wars have been destroyed. The NATO plans for "up-arming" and "compensation," other militaristic programs, and the entire course of military organizational development being implemented in NATO states following lines of the essentially aggressive doctrine of "direct confrontation" are proof of this. Western strategists continue to resort to the policy of acting "from a position of strength." In adhering to this political course, for example, the United States even rejects international talks on issues concerning spheres in which Washington has superiority, particularly on reducing the level of military confrontation in areas where the coasts of the USSR, China, Japan, the DPRK and South Korea converge.

In addition, the United States is attempting to hinder talks already under way on reducing strategic offensive arms. While delaying or even threatening to disrupt this work of importance to the cause of peace, the White House continues to build up these arms by creating favorable conditions for the military-industrial complex to produce strategic B-2 bombers and Trident II ballistic missiles for submarines, and it is accelerating research under the "star wars" program.

The most reactionary western circles still have not gotten rid of imperial ambitions. To be successful in their claims to world domination they are stepping up not

only production of the latest arms, but also "psychological warfare," in which one of the most important places is set aside for an imperialist interpretation of the problem of war and peace. At the present stage of historical development imperialism is broadening the scope of ideological subversion with the objective of undermining the moral-political and psychological state of the populace and armed forces of socialist and other countries, intervening in their internal affairs, and arousing mistrust and enmity among states and peoples.

An effective campaign against hostile ideology is possible only on principles of creative Marxism-Leninism. The 19th All-Union CPSU Conference noted that deviations from these principles left a difficult mark in ideology. Its theoretical level dropped and propaganda often ran contrary to the realities of life. In essence, ideological work was at the service of dogmatic ideas of socialism, it lost its critical attitude toward reality, and thus it promoted stagnant phenomena.

Experience gained in restructuring military life clearly shows that all ideological and political indoctrination work must be arranged so that the person is constantly the focus of attention, ideas win the masses over more and more widely, and theory becomes a really material force. This is achieved by developing proper ideas in servicemen about honor, dignity, comradeship and friendship; by instilling patriotism and internationalism; and by establishing the high authority of conscientious military labor and unwavering allegiance to military duty.

In the course of perestroika there has been a decisive turn of commanders, political entities, and party and Komsomol organizations toward questions of relations among nationalities in Army and Navy collectives. The task is to make service in Soviet Army and Navy ranks a genuine school of international indoctrination. This requires a knowledge of the culture and traditions of our country's peoples, thoughtfulness, an equal and even attitude toward soldiers of different nationalities, identical demands on and concern for them, and uniting the personnel on principles of friendship and brotherhood.

It is only by democratization that we can break once and for all the mechanisms of inhibition still preserved in the Armed Forces—formal bureaucratic methods, the inertia of unwarranted leveling, consumerism, a free-ride mentality, an acute lack of individual work with people, and the psychology of hazing new conscripts which exists in some servicemen. Glasnost is an effective weapon of perestroika and democratization. USSR Minister of Defense D. T. Yazov remarked that "the atmosphere of glasnost promotes the personnel's development of an active position in life, realization of the organizing and indoctrinating capabilities of public opinion, and the establishment in military collectives of an atmosphere of

high political activeness and irreconcilability toward any stagnant manifestations, instances of unconscientiousness, lack of execution, and nonregulation relationships."

The basis of our Army and Navy's combat might is the dialectical unity of material and spiritual factors, with ideological staunchness being the most important one. V. I. Lenin remarked: "Victory in any war is determined in the final account by the state of morale of those masses who are spilling their blood on the battlefield" ("Polnoye sobraniye sochineniy" [Complete Collected Works], Vol 41, p 121).

The need for developing high ideological staunchness in Soviet servicemen is explained by the intensified opposition of the two social systems in the ideological sphere, the presence of sophisticated military technology, and the diverse nature of modern warfare. The political vigilance of our Motherland's defenders, their ability to expose the fantasies of bourgeois ideologues in a well-reasoned manner, and class irreconcilability toward imperialism, neocolonialism, reaction, and enemies of peace, democracy and social progress are honed in active ideological struggle.

Our irreconcilability toward bourgeois ideology does not arise in the form of a blind, fanatic feeling, but matures as a profound understanding of the fundamental difference of ideals, programs, objectives and means of attaining them in the opposing social systems. We are irreconcilable toward imperialism, which is a constant source of social tragedies, aggressive politics, the arms race, and the threat to the national liberation movement. Imperialism also is inimical to us because of its plans to "crowd out" and "drive back" or even destroy socialism. Imperialist ideology reflects oppression and violence, which is why it is unnatural to socialist ideology.

Purposeful ideological and political work of commanders, political entities, and Army and Navy party and Komsomol organizations and the Army structure which formed based on principles of Soviet military organizational development and on demands of the oath and regulations play a deciding role in indoctrinating servicemen.

The continuous growth in the amount of various information and in its distribution channels requires accomplishing the important and fundamental task of developing Soviet servicemen's strict discrimination in selecting available information. Ideological staunchness expressed in true Marxist convictions which have become an immutable position in life acts as the principal ideological filter which will not pass something hostile or amoral.

The basic property of ideological staunchness is its effectiveness. It will not accept an indifferent attitude toward something. The criteria used in checking a person's ideological staunchness are considered to be his independent affairs, acts, and principled defense of a

scientific viewpoint. Ideological staunchness characterizes the attitude toward the Motherland, one's people, traditions and public duty and serves as a very important motive for an individual's conduct.

The supreme manifestation of a Soviet serviceman's ideological staunchness is his constant readiness to enter into armed struggle against the homeland's enemies and worthily rebuff an aggressor. This quality is developed by instilling a profound communist conviction, high morale, responsibility and a sense of duty.

Ideological staunchness is one of the most valuable moral-political qualities of the socialist homeland's defenders. Confidence in a triumph of communist ideals based on profound theoretical conclusions of Marxism-Leninism helps them properly understand the complex processes of social development and questions of international life, withstand any ideological subversion, and worthily perform patriotic and international duty. This is shown by exploits of Soviet soldier-internationalists, Heroes of the Soviet Union officers Ye. Vysotskiy, Yu. Kuznetsov, R. Aushev, G. Kuchkin, V. Pimenov, F. Pugachev, N. Shornikov, I. Zaporozhan, N. Maydanov and others who honorably performed their duty on the soil of Afghanistan. Readiness for an exploit and orientation on it have become the most important characteristic traits of ideological staunchness of those who serve in the USSR Armed Forces. Therefore it is not by chance that the military labor of our servicemen was given a high evaluation in the CPSU Central Committee Political Report to the 27th CPSU Congress, where it was noted that "the Soviet Army and Navy have modern arms and equipment, well trained personnel, and trained command and political cadres who are utterly dedicated to the people. They worthily perform their duty in the most difficult and sometimes severe situation."

Marxism-Leninism, the supreme revolutionary ideology, is the methodological basis for instilling ideological staunchness in Soviet servicemen. A firm knowledge and mastery of the theoretical fundamentals of Marxist-Leninist science and communist ideology qualitatively change servicemen's public and individual awareness and make it politically acute and mature in a class sense, which promotes more effective accomplishment of the specific tasks of strengthening combat might and improving combat readiness of Army and Navy forces.

The CPSU's constant concern for shaping communist conviction broadens the capabilities for managing a person's spiritual development and raising his awareness. The concept of "manipulation" of people's awareness exists in bourgeois society; it signifies the ability to influence in such a direction as to make axiomatic such concepts as the perpetuity of man's exploitation of man, the inevitability of wars and so on. Imperialism's enormous propaganda machine is widely used for this purpose. The principal objective of such "manipulation" is to deform the truth, distort the real state of affairs, and reinforce the system of exploitation and coercion.

Management of people's spiritual development in socialist society fundamentally differs from the capitalist machine of "manipulation." In accordance with the Leninist methodology of indoctrination, the basis of socialist management of spiritual development is the striving to make awareness conform in the fullest possible manner to the principles inherent to socialism, which implements the principle of "everything for man, everything in the name of man." For the first time in history it has become possible not to impose ideas, but to integrally link the objective truth of Marxism-Leninism with the toiling masses' fundamental interests. This is what explains the profound need of Soviet citizens and Army and Navy personnel for spiritual development, political enlightenment and ideological conditioning.

Development of servicemen's social consciousness and awareness depends to an enormous extent on the ability, will and determination of commanders and political officers to wage an irreconcilable campaign against hostile ideological influence. Lenin's words that "if they cannot go against us now with guns in hand, they go with the weapon of lies and slander" ("Polnoye sobraniye sochineniy," Vol 42, p 366) are current today as never before. The class enemy does everything to introduce Soviet servicemen to alien ideas, bourgeois stereotypes of thinking, false ideas and distorted information, and uses the enormous propaganda apparatus and all the "brainwashing" means in his hands for this purpose. The press, radio, movies and television are mobilized to conduct "psychological operations" against countries of socialism. The airwaves are literally saturated with slanderous fabrications about the life of peoples of the Soviet Union and fraternal countries of socialism and about the allegedly heavenly life in countries of capital.

The enemies of socialism strive by various ways to exert a corrupting influence on the consciousness of Soviet citizens and Armed Forces personnel, and sometimes they succeed. Those infected with pacifist sentiments also are found among draftees; some of them display a lack of concern and skepticism about the need for strenuous military labor. Young people also come into the Army and Navy who do not cherish friendship and comradeship and who are prisoners of nationalistic delusions. All this requires devoting primary attention to ideological indoctrination work in each military collective.

Elevating the spiritual sphere's role and overcoming its underestimation must be at the heart of this work. The 19th All-Union Party Conference concluded that the CPSU views society's spiritual renewal as an exceptionally important component of the process of deepening perestroika. The transition to its second, practical, stage showed that now the significance of the spiritual factor and its interrelationship with political, economic, social and other transformations is substantially growing. The demands placed on the mechanism for shaping a spiritual potential of society which would work reliably for

perestroika and for increasing its results also grow with consideration of this. The party gives indoctrinational work an active and responsible role in attaining the objectives of perestroika.

The process of a profound restructuring of the content, forms and methods of ideological work and of instilling ideological staunchness in servicemen stepped up in the Army and Navy following the 19th All-Union CPSU Conference. What are the directions in which this renewal is taking place?

First, "gross-numbers" indoctrinational activities are being eliminated, a selective approach to the person is being established, and individual awareness and public opinion are being formed in the military collective with consideration of the "feedback" mechanism.

Second, political studies are being brought as close as possible to life and the tasks being accomplished by the military collective. Active training forms are being introduced and dialogue, discussion and debate are being encouraged, which permits developing sociopolitical boldness and helps form and strengthen skills in defending one's convictions.

Third, party organizations' attention to ideological work is being strengthened and demands on those who are unconcerned with personal contribution to the job of raising the spiritual potential of the multinational military collective are being increased.

Fourth, Soviet servicemen's sentiments, needs, and how they feel socially are being studied more deeply. A center for the study of public opinion in military collectives has been established for this purpose under the Main Political Directorate of the Soviet Army and Navy.

Fifth, heroic-patriotic and international indoctrination is being used more widely and love for military labor is being instilled in forming ideological staunchness. The activity of the Army and Navy mass media as well as of cultural enlightenment establishments is moving to a qualitatively new level.

Thus Soviet servicemen's high ideological staunchness is being developed by exerting a constant ideological influence on them in the course of combat and political training and performance of duty and in organizing their everyday life and leisure. For this it is very important to skillfully analyze improvements in public and individual consciousness, keep a vigilant eye on the real state of people's awareness and make necessary adjustments to the indoctrination process. The personnel's awareness and ideological staunchness naturally grow and discipline, efficiency and, in the final account, combat readiness are elevated where ideological indoctrination and combat training are dialectically tied together and where the most effective forms and methods of ideological influence are skillfully used.

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### FRG Armed Forces

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[Article by Lt Col V. Lyudchik]

[Text] The FRG's military-political course in the present stage is aimed at further increasing the country's role in NATO, comprehensively strengthening ties with the United States, expanding and deepening Franco-West German military cooperation, and continuously building up Bundeswehr combat might.

The FRG leadership actively participates in developing and conducting a coordinated North Atlantic Alliance military policy toward the Warsaw Pact, it is assuming the principal obligations for building up combat capabilities of the bloc's Allied Armed Forces, and it is exerting a constant pressure on West European allies for increasing their contribution to collective militarist preparations.

The FRG holds a leading place among West European NATO member countries in the scale of military expenditures, financing about 25 percent of the bloc's overall activities. Its government allocated considerable amounts for carrying out basic bloc programs and was one of the first to decide to have the country participate in the American "star wars" program.

West German militarists have turned the Bundeswehr (495,000 persons) into the most powerful army in Western Europe, an army considered the principal striking force of NATO Allied Forces Central Europe. The FRG presently has its own military industry capable of producing almost all kinds of modern weapons and military equipment. Bundeswehr generals hold many leadership positions in the bloc's highest military-political entities, and former FRG Minister of Defense M. Wörner was elected to the post of Secretary-General of NATO, which permits West Germany to exert a substantial influence on the shaping of NATO policy.

The FRG military-political leadership is undertaking active efforts to further build up the combat might of the country's Armed Forces (established in 1955 in accordance with the 1954 Paris Agreements), which are being developed in accordance with the Bundeswehr's long-range program of organizational development up to the year 2000. The program provides for improving the organizational structure of the Army, Air Force and Navy and specifies the most important directions for purchasing and modernizing arms and military equipment. With the projected cutback in the American nuclear arsenal in Europe, it is planned to concentrate basic efforts on building up conventional Bundeswehr arms in the course of its reoutfitting.

West Germany's military expenditures grow from year to year (DM48.1 billion in 1984 and DM51.4 billion in 1988). Their share of the FRG state budget approaches 18 percent. The FRG's overall military expenditures in 1988, counting financial assets allocated from the budgets of other ministries and departments, will be around DM63 billion.

**Supreme military control entities**, including a Federal Security Council and Ministry of Defense, have been established for directing the FRG Armed Forces in peacetime.

The Federal Chancellor will be the supreme commander of the Armed Forces in wartime. In peacetime he is chairman of the Federal Security Council, the supreme consultative entity for military-political questions. The Vice-Chancellor (who is as a rule the Minister for Foreign Affairs); ministers of defense, interior, finance, and economics; as well as the Bundeswehr General Inspector are included in the Federal Security Council in addition to the Chancellor. If necessary, other ministers and supreme military leaders can take part in the Council's work. It considers proposals on the most important questions of Armed Forces organizational development and coordinates activities of supreme military and civilian entities in this sphere as well as in the spheres of military economics and mobilization.

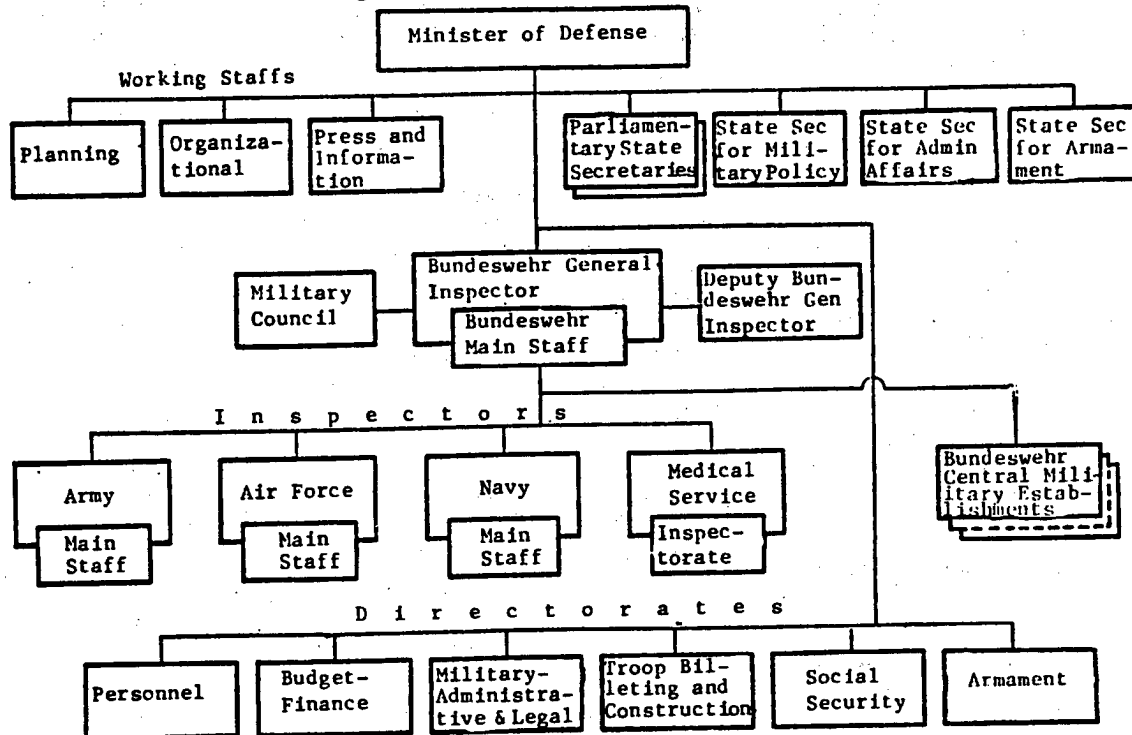
The Minister of Defense (a civilian), who is appointed by the President at the proposal of the Federal Chancellor, exercises overall leadership of the Armed Forces in peacetime.

The Minister of Defense has five deputies: two parliamentary state secretaries and state secretaries for military policy, administrative affairs, and armament, who also are appointed from among civilians. The Minister of Defense exercises leadership of the Armed Forces through the Ministry of Defense (Fig. 1), the central entity for managing the Bundeswehr, which includes the Bundeswehr Main Staff, Military Council, main staffs of the Army, Air Force and Navy, Medical Service Inspectorate, six directorates (personnel, budget-finance, military-administrative and legal, troop billeting and organizational development, social security, armament), three working staffs (planning, organizational, press and information), and other central establishments and units.

In the assessment of foreign specialists, the system of supreme military control entities permits the Bundeswehr command to exercise command and control in war after slight organizational changes are made in central establishments and individual staffs in the period when the Armed Forces are being shifted from a peacetime to a wartime footing.

The General Inspector (CIC) exercises operational direction of the Armed Forces through the Bundeswehr Main Staff and inspectors (commanders) of branches of the Armed Forces, who direct troop activities through main

Fig. 1. FRG Ministry of Defense organization



staffs. He also is the chairman of the Military Council, which is a coordinating and consultative entity. In addition to him, the Military Council includes the Deputy General Inspector and inspectors of branches of the Armed Forces and the Medical Service. Chiefs of directorates and departments of the Ministry of Defense as well as experts can be included in the work of the Military Council as consultants.

The Bundeswehr Deputy General Inspector directs the activity of central military establishments of the Armed Forces and performs duties of the General Inspector in the latter's absence.

The Bundeswehr Main Staff essentially performs the functions of a general staff. It develops general military concepts and plans for organizational development and employment of the Armed Forces; coordinates the work of main staffs of the Army, Air Force and Navy and of the Medical Service Inspectorate; exercises direction of ideological work, manning, troop instruction and combat training, intelligence, and Bundeswehr central military establishments; and handles questions of FRG participation in NATO.

The Main Staff includes seven directorates: ideological work, personnel, and combat training; intelligence; military policy and operations; organizational; logistics; planning; communications and electronics. Directorates are subdivided into departments, which differ from each other in functional purpose.

The main staffs of the Army, Air Force and Navy consist of directorates similar to those of the Bundeswehr Main Staff, but each of them accomplishes tasks of its own branch of the Armed Forces.

The working staffs are Ministry of Defense agencies responsible for drawing up materials needed by the Ministry of Defense leadership for decisionmaking on questions of long-range strategic and military-political planning, as well as for publications about the Bundeswehr, relations with public organizations, office procedures, internal radio communications and other matters. They are directly subordinate to the Minister of Defense.

Central military establishments are intended for accomplishing tasks in the interests of branches of the Armed Forces and of the Bundeswehr as a whole. They include a number of directorates (central, personnel, SIGINT, military counterintelligence, military-scientific and military-historical), the Academy, Bundeswehr universities, and other departments.

The Army is the basic and largest branch of the Armed Forces (340,000 persons). It consists of the Field and Territorial armies.

The *Field Army* is the most combat-ready component of the Army (it includes some 80 percent of Army personnel). In peacetime large and small units of the Field Army are assigned for transfer to the NATO Allied Forces. They are kept in a high state of combat readiness

and are at 85-90 percent strength in personnel and 100 percent in weapons and equipment. The Army Inspector (CIC) exercises direct control over them through the Main Staff.

The Field Army is organized as army corps and divisions. There is a total of 12 divisions (four mechanized infantry, six armored, one mountain infantry and one airborne), 11 of which are in I, II and III army corps. The I Army Corps includes the 11th Mechanized Infantry Division and the 1st, 3d and 7th armored divisions; II Army Corps includes the 4th Mechanized Infantry Division, 1st (8th) Mountain Infantry Division, 10th Armored Division and 9th Airborne Division; III Army Corps includes the 2d Mechanized Infantry Division and the 5th and 12th armored divisions. The 6th Mechanized Infantry Division, intended for conducting combat operations together with the Danish Army in the Northern European sector, is not included in the army corps. During a war these army corps will function in operational formations of the NATO Ground Forces in the Central European sector (I Army Corps in the Northern Army Group and II and III army corps in the Central Army Group) and are an important combat component of them.

An army corps is the highest tactical unit of the Field Army. It can include from three to five divisions of different types and units and subunits of corps subordination, which are permanent and of the same type for those army corps. They are the basis of command authorities of the combat arms: missile troops and artillery; tactical air defense; army aviation; signal troops; engineer troops; logistics; repair, overhaul and rebuilding service; and medical service. In addition, organic corps subunits which are not part of the command authorities include deep and front reconnaissance companies as well as four reserve battalions.

An army corps, which includes, for example, two armored divisions and one mechanized infantry division, can have around 100,000 personnel, six Lance operational-tactical missiles, 900 medium tanks, 500 ATGM launchers, 400 guns, multiple-launch rocket systems (Fig. 2 [figure not reproduced]) and mortars, and 500 air defense weapons including 36 Roland surface-to-air missile systems.

The division is the basic tactical large unit. It is capable of conducting combat operations under conditions of the use of nuclear and conventional weapons both as part of the army corps and independently. Divisions of the Bundeswehr Field Army differ according to the types of brigades included in them. The mechanized infantry division has two mechanized infantry brigades and one armored brigade, the armored division has two armored brigades and one mechanized infantry brigade, and the mountain infantry division has a mechanized infantry

brigade, armored brigade and mountain infantry brigade. The organization and armament of brigades as well as of units and subunits of division subordination remain type in all divisions.

Units and subunits of all combat arms are represented in the division. The division has great firepower and striking power. It is equipped with Leopard tanks; Marder infantry fighting vehicles (see color insert [color insert not reproduced]); field artillery, including 203.2-mm and 155-mm self-propelled howitzers capable of employing nuclear ammunition; antitank weapons, particularly the Milan, TOW and HOT antitank missile systems; and air defense weapons including the Gepard self-propelled AA mount. The airborne division is the exception, differing from the others in organization and armament. It includes three airborne brigades and a signal battalion. The airborne brigade usually operates in the interests of one of the army corps. It is armed with a considerable number of Milan and TOW antitank missile systems.

The *Territorial Army* is intended for accomplishing a wide range of missions in the interests both of the Bundeswehr and of support to combat operations of NATO Allied Forces Central Europe and partially of Allied Forces Northern Europe. In addition, they are a base for mobilization deployment of the Armed Forces.

Among the basic missions of the Territorial Army are supporting Bundeswehr mobilization deployment and NATO Allied Forces operational deployment on FRG territory; participating in combat operations as part of FRG army corps; providing combat and logistic support to American troop reinforcements; defending rear areas and combating airborne and amphibious assault forces; securing and defending important state, military and industrial installations, transportation routes and lines of communication; training reservists in peace and wartime; and replacing losses of large and small army units in the course of a war.

The Territorial Army is in three territorial commands (Schleswig-Holstein, North, and South); subordinate to them are six military districts, individual commands (signal, logistics, engineer, medical), 12 brigades and 15 regiments of Home Defense, 29 region and 80 subregion defense staffs, and 150 security companies and 300 security platoons.

It is planned to transfer deployed Home Defense brigades together with army corps to the operational subordination of the NATO Allied Forces Command. These brigades will be employed tactically under plans of FRG army corps.

In peacetime the large and small units and subunits of the Territorial Army are at 10 percent strength in personnel and 100 percent in weapons and military equipment. According to foreign press data, their peacetime personnel strength is 50,000 and in wartime it can be taken to 600,000.



The Army now has 24 Lance operational-tactical missile launchers, over 4,800 tanks including 1,800 Leopard 2, over 2,100 Marder infantry fighting vehicles, 2,100 field artillery pieces and mortars (105-mm and larger), some 2,740 antitank missile systems, 140 Roland surface-to-air missile systems, 400 Luchs combat reconnaissance vehicles, 3,500 APC's, 2,300 AA guns, and 700 army aviation helicopters, of which 200 are antitank helicopters.

The Air Force (some 111,000 persons and 680 combat aircraft) is headed by the Air Force Inspector, who handles organizational development and directs combat training of large and small units. The West German Air Force includes a Tactical Command, Support Command and Air Force Office.

The *Tactical Command* (headquarters at Porz-Wahn Air Base) is the highest Air Force operational formation, intended for accomplishing missions of support to combat operations of branches of the Armed Forces. According to information published in the foreign press, the Tactical Command includes the 1st and 3d air support divisions, the 2d and 4th air defense divisions, the FRG Air Force Training Command in the United States, a liaison group with the U.S. Air Force in Europe, and other entities. Command and control of Tactical Command is exercised by a commander in chief through his staff.

The 1st and 3d air support divisions are intended for accomplishing missions in the interests of branches of the Armed Forces. Each of them has a Pershing-1A missile squadron (36 launchers), 5-7 fighter-bomber squadrons, one reconnaissance squadron as well as other subunits. These divisions are capable of conducting combat operations employing both conventional and nuclear weapons.

The 2d and 4th air defense divisions are intended for accomplishing missions in the NATO allied air defense system. A division includes a fighter squadron, 2-4 surface-to-air missile regiments and two signal regiments. The fighter squadrons have F-4F aircraft and Nike-Hercules, Improved Hawk and Roland III surface-to-air missile regiments.

The FRG Air Force Training Command in the United States engages in training flight and engineering-technical personnel for air and missile units.

The *Air Force Support Command* (Porz-Wahn) accomplishes missions of planning requirements and supplying units with items of logistic support, purchasing and distributing aviation equipment and supporting equipment, as well as moving troops and freight by air in the interests of branches of the Armed Forces. To accomplish the latter mission, the following are administratively subordinate to the CIC of the Air Force Rear: Air Transport Command, Air Force logistic support groups (North and South) and the Air Force Logistic Support

Office. The command element has a considerable number of central and field depots and transportation resources. An information service has been established in it to improve the organization of logistic support.

The Air Transport Command (Münster) unites three air transport squadrons, a transport helicopter squadron and a special-purpose group engaged in government air movements. The command has 200 military transport aircraft and helicopters.

The *Air Force Office* (Porz-Wahn) organizes personnel training in military educational institutions and plans the organization and course of combat training in units. The following are subordinate to the Office chief: commands (FRG Air Force Training Command in the United States, headquarters services), directorates (personnel, military geophysics), and other units and subunits.

The air squadron is the basic operational-tactical combat unit and consists of two detachments of 18 aircraft each as well as of technical and airfield service subunits.

The FRG Air Force has a total of 73 F-104G, 152 F-4F and 180 Tornado (Fig. 3 [figure not reproduced]) fighter-bombers, 173 Alpha Jet light attack aircraft, 76 RF-4E reconnaissance aircraft, 89 C-160 Transall military-transport aircraft, 110 UH-1D general-purpose helicopters, 72 Pershing-1A missile launchers, and 216 each Nike-Hercules and Improved Hawk surface-to-air missile launchers.

The basic forces of combat aviation, operational-tactical missiles and surface-to-air missiles of the FRG Air Force are included in the 2d and 4th allied tactical air forces of NATO Allied Air Forces Central Europe and, in the opinion of foreign specialists, represent the most powerful air grouping in this sector (after the U.S. Air Force). Some forces of the West German Air Force are included in the NATO Allied Air Forces Baltic Approaches.

The FRG airfield network includes some 400 airfields and landing strips. The most important airfields are considered to be Ahlhorn, Wittmund, Landsberg, Neuburg, Oldenburg, Ingolstadt, Memmingen and Fürstenfeldbruck.

The FRG Navy (over 36,000 persons) includes naval and naval support commands as well as a Central Navy Office.

The *Naval Command* (Glücksburg) controls the day-to-day activity and combat training of naval forces and naval aviation. The Navy CIC is responsible for the state of combat readiness of Navy ships and units, planning of exercises and analysis of their results, organization of logistic support and communications, and other matters. Subordinate to him are four flotillas of combatant ships (submarines, destroyers, fast attack missile craft, mine countermeasure forces), a supply flotilla, a division of

naval aviation, an amphibious group, naval tactics training group, headquarters services command, as well as a command of FRG naval forces in the North Sea, which is assigned some of the naval forces and naval aviation for a period of exercises.

The *Naval Support Command* (Wilhelmshaven) plans and organizes comprehensive supply of ships and shore units, routine inspection, servicing and maintenance work, repair work and other activities. Subordinate to it are commands of naval basing areas on the North and Baltic seas, which include naval bases and basing facilities, depots and support subunits.

The *Central Navy Office* (Wilhelmshaven) performs missions of organizing the training of all categories of servicemen, conducting military research, and providing medical support to personnel. Subordinate to it are test ranges, educational institutions and naval ships.

The FRG Navy fighting strength consists of 24 submarines (18 Type 206 and six Type 205), seven guided missile destroyers (three "Lütjens"-Class and four "Hamburg"-Class), six "Bremen"-Class guided missile frigates (Fig. 4 [figure not reproduced]), two "Köln"-Class frigates, six small antisubmarine ships (corvettes), 40 fast attack missile craft (20 Type 148, 10 Type 143A, 10 Type 143), 57 minesweepers, and 22 small landing craft. Naval aviation includes 112 combat aircraft and 14 helicopters.

The principal FRG naval bases are Wilhelmshaven, Kiel, Bremerhaven, Olpenitz, Flensburg and Cuxhaven.

**The Armed Forces are manned** on the basis of the 1956 laws on universal military service and on the legal status of servicemen. The Law on Universal Military Service specifies the procedure for manning the Armed Forces both in peacetime and wartime, and the Law on Legal Status defines the rights and obligations of all categories of servicemen. In accordance with the Law on Universal Military Service, all FRG male citizens in the ages of 18-45 (rank-and-file) and up to 60 (officers and NCO's) are subject to military service obligation in peacetime, and in wartime all males in ages up to 60 are subject to military service obligation.

The supreme entity for manning the Armed Forces is the Bundeswehr personnel directorate. It coordinates the activity of the administrative management directorates of six military districts, to which are subordinate 96 subregion manpower acquisition departments which keep records on draftees and reservists, give them medical examinations to determine fitness for duty, and allocate them in accordance with incoming requisitions.

According to West German law, service in the Armed Forces is active (in a period of training courses), or unlimited (in wartime). The following are on active Bundeswehr military service: first-term servicemen (15 months; 18 months beginning 1 July 1989), who perform

duty under contract (from 2 to 15 years); and regular military (they serve to an established maximum age). All male FRG citizens in ages from 18 to 28 are obligated to perform compulsory military service. Persons subject to military service obligation who refuse to serve are brought in to perform so-called "civilian service" lasting 20 months in psychiatric hospitals, clinics, old people's homes and so on. The call-up for compulsory service is carried out quarterly.

Persons from among those subject to military service obligation who have expressed a desire to serve in the Bundeswehr and military personnel in their compulsory term of service are selected for contract service. Cadre military personnel are selected from among persons subject to compulsory military service (for training as officers) and from NCO's serving under contracts.

Servicemen who have completed active duty are enrolled in the ready reserve and remain assigned to the units for 12 months. During this time they can be called up to the units by decision of the Minister of Defense without declaration of mobilization in the country. At the expiration of that time period the reservists are transferred to the first or second degree reserve, and then are included in the general reserve.

Before call-up, all persons undergo medical examination to determine their fitness for military service. Candidates for contract service additionally are given further checks during which their fitness is established based on personal qualities and mental and physical development. After the results of these checks are processed, volunteers are distributed by branches of the Armed Forces in accordance with incoming requisitions.

In the opinion of the Bundeswehr command, the existing principle of manpower acquisition best meets Armed Forces requirements for highly skilled specialists capable of rapidly mastering and effectively using sophisticated military equipment and it allows conducting mass training of the reserve.

Based on data published in the foreign press, the numerical strength and effective strength of branches of the FRG Armed Forces in peacetime will be kept at the existing level. Great changes will occur in the Army. In particular, by the mid-1990's it is planned to shift to a new organization and establishment called "Structure-2000," increase the number of brigades in the ground forces to 42 by transferring to them six separate Territorial Army brigades, and carry out a number of organizational changes in brigades and battalions. The Bundeswehr command plans to concentrate principal efforts on outfitting Army and Navy forces with modern systems of weapons and military equipment to increase their combat power.

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**UK Military Presence Abroad**  
18010378c Moscow ZARUBEZHNOYE VOYENNOYE  
OBOZRENIYE in Russian No 12, Dec 1988 (signed to  
press 7 Dec 88) pp 14-16

[Article by Col A. Alekseyev]

[Text] Great Britain's military-political leadership follows a foreign policy course aimed at strengthening its positions in Western Europe and NATO, retaining influence in various regions of the world and maintaining control over its remaining colonial possessions (see diagram [diagram not reproduced]). While London was cutting back its military presence in areas "east of Suez" in the first half of the 1970's in order to focus main attention on Europe, and above all on elevating its role in the North Atlantic Alliance, beginning in 1979 M. Thatcher's Conservative government set a course toward reinforcing Great Britain's positions not only in Europe (the FRG, West Berlin, Gibraltar, Cyprus), but also in other regions of the world—Hong Kong, Brunei, Belize, Falkland (Malvinas) Islands and so on.

In accordance with this political trend, in the early 1980's former Secretary of State for Defense J. Nott declared in the House of Commons: "Great Britain is ready together with NATO allies, and particularly the United States, to use force to defend the West's interests in strategically important areas of the globe." The basic directions of Great Britain's military strategy were set forth at that time in the "White Book on Defense Issues for Fiscal Year 1981/82," where the following were singled out above all:

—Giving military assistance to developing states with the objective of strengthening its position in them by means of arms deliveries, sending British specialists to train personnel of national armed forces, and training servicemen of these countries in UK educational institutions;

—Periodic deployment of troops in peacetime in strategically important parts of the world under the guise of conducting exercises, maneuvers and ship visits.

Subsequently the interventionist foreign policy aspirations of the UK Conservative government took the form of actual employment of armed forces, particularly during the Anglo-Argentine conflict in 1982, when a striking force was created in short time periods and sent to the Falkland (Malvinas) Islands. Its basis was combatant ships, naval aviation, and units of the 5th Separate Mechanized Infantry Brigade and the 3d Royal Marine Brigade. During the landing operation these troops broke the resistance of Argentine troops and took the islands.

At the present time the Falkland (Malvinas) Islands have been turned into a British military base in South America, where subunits of the Army, Air Force and Navy are permanently stationed. According to western press

announcements, there is a garrison of almost 3,000 British troops on these islands, there are radar stations for monitoring air space over the South Atlantic, and the airfield has been placed in operation for receiving heavy military transport aircraft.

The experience of deploying troops during this conflict and of their combat operations was taken into account by the British command authority in establishing the "Rapid Deployment Force" in 1984. The 5th Separate Airborne Brigade, 3d Royal Marine Brigade and certain other units and subunits became part of this force. The Rapid Deployment Force is intended for conducting combat operations in any part of the world where a threat to "British interests" may arise, and above all in former colonies in Africa, Asia, the South Atlantic and the Caribbean basin, as well as for giving military assistance to pro-western states in putting down the national liberation movement. The overall numerical strength of these forces is more than 10,000 persons. Possible options of deploying the Rapid Deployment Force are worked out in exercises.

Movements of Rapid Deployment Force subunits are assigned to the Navy and Air Force. The largest of them (after the Anglo-Argentine military conflict), as noted in the journal DEFENCE, was carried out during Exercise Swift Sword held in Oman in 1986. The exercise worked problems involving a practice air-sea assault operation by British subunits moved in with the mission of "giving assistance to Omani troops in driving out an enemy who has invaded their territory." A parachute battalion, Marine battalion, and subunits of the Royal Navy and Royal Air Force took part in the exercise. The parachute battalion was airlifted to the island of Masirah, which belongs to Oman, and the Marine battalion was delivered aboard the assault ship "Intrepid." Tornado aircraft flew 7,400 km from Great Britain to Oman with five aerial refuelings. The overall numerical strength of personnel who took part in the exercise reached 4,700 persons.

That same year separate subunits of British troops took part in military exercises on Cyprus, in Kenya, Brunei, Australia, Malaysia, Botswana and New Zealand.

As the "White Book" (FY 1987/88) points out, Great Britain "is responsible for the defense of 13 dependent territories." In addition, it has military agreements with a number of countries which are its former colonies. It is also stressed that many thousands of British citizens are living abroad whose safety is directly dependent on the stability of the situation in the areas where they reside. These arguments are cited in justification of the presence of British troops on foreign territories.

The largest grouping of UK troops is stationed in the FRG (British Army of the Rhine and the Royal Air Force command in the FRG with headquarters in Rhein-dahlen). Western military specialists believe that the former is a significant UK contribution to the NATO

military organization. Its CIC is at the same time Commander, Northern Army Group of NATO Allied Forces Central Europe. The British Army of the Rhine includes I Army Corps (headquarters in Bielefeld) and a separate mechanized infantry brigade in West Berlin. The I Army Corps is the most combat-ready large unit of British troops; it is outfitted with nuclear attack weapons and other modern arms. It includes three armored divisions. Overall numerical strength reaches 50,000 persons. The separate mechanized infantry brigade stationed in the British zone of West Berlin numbers some 3,000 persons. In the assessment of western specialists, in a period of mobilization deployment the numerical strength of British ground forces in the FRG can grow to 140,000 persons through the movement of large and small units from the home country.

The Royal Air Force command in the FRG is directly subordinate to the Royal Air Force chief of staff (commander in chief) in the British Armed Forces and is intended for operations in the Central European sector as part of the 2d Allied Tactical Air Force of the NATO Allied Air Forces. It includes 12 combat squadrons (the 3d and 4th squadrons of Harrier-GR.3 tactical fighters at Gütersloh; 9th, 14th, 17th and 31st squadrons of Tornado-GR.1 tactical fighters at Brüggen; 15th, 16th and 20th squadrons of Tornado-GR.1 tactical fighters; 2d Squadron of Jaguar-GR.1 aircraft in the reconnaissance version; 19th and 92d squadrons of Phantom-FGR.2 air defense fighters, Wildenrath); 60th Squadron of Pembroke liaison aircraft (Wildenrath); 18th and 230th squadrons of Chinook-HC.1 and Puma-HC.1 helicopters (Gütersloh); and 16th, 26th, 37th and 63d squadrons of Rapier surface-to-air missiles (Wildenrath, Laarbruch, Brüggen and Gütersloh respectively).

The British government continues to keep its hands on Gibraltar, the right to which is being disputed by Spain. Talks between the two countries have led only to the establishment of a neutral zone (some 500 m wide) along the Spain-Gibraltar border. On the territory of Gibraltar are located the headquarters of the Royal Navy Flag Officer Gibraltar, a naval base, separate mechanized infantry battalion and other subunits (overall numerical strength is around 1,000 persons).

The naval base can receive and service ships of all types. On its territory it has a ramified network of underground tunnels and galleries which accommodate a communications center and naval center for surface situation coverage, a navy hospital, supply depots in case of military operations, and tanks for potable water.

In peacetime the Flag Officer may have at his disposal two or three ships of basic types, one or two ocean minesweepers, several submarines, an infantry battalion, a subunit of engineer troops and a service subunit. He is given additional combatant ships and aircraft of naval aviation of other participating countries (primarily the United States and Spain) when the situation becomes aggravated or for the period of NATO Allied Forces

exercises. In wartime these forces will accomplish missions of maintaining control over the Strait of Gibraltar, combating enemy submarines and ship striking forces, and protecting sea lines of communication.

Up to two mechanized infantry battalions, a Royal Air Force helicopter squadron and other British subunits are located on the island of Cyprus, which is part of the Commonwealth of nations. Great Britain retains the right to use some three percent of the island's area for its military bases (250 km<sup>2</sup>). The overall strength of British troops stationed on Cyprus is almost 3,200 persons, around a third of whom are part of the UN armed forces assigned to prevent clashes between Greek and Turkish communities and to prevent antigovernment uprisings.

British troops also are stationed in areas "east of Suez." Secretary of State for Defense G. Younger repeatedly declared that Great Britain "continues to have interests in Asia." A separate mechanized infantry brigade and a subunit of the Royal Navy (a total of some 6,000 persons) are stationed in Hong Kong.

Hong Kong is to be returned to China in 1997 based on an agreement reached between the governments of Great Britain and the PRC. Western specialists believe that in this connection the importance of Brunei, where a separate mechanized infantry battalion and a helicopter flight are stationed, is growing in London's policy. This small state, situated in the northern part of the island of Kalimantan, was freed of British colonial rule in May 1984, but remained a member of the Commonwealth. It entered the Association of South East Asian Nations (Indonesia, Malaysia, Singapore, Thailand, the Philippines).

Younger visited Thailand, Malaysia, Singapore and Brunei in April 1987. During the visit he stated that in connection with the upcoming transfer of Hong Kong to China, it is necessary to revise UK military policy in this area, step up the activity of the five-nation military alliance, and connect Brunei to it.

A reinforced mechanized infantry battalion numbering 1,300 persons is stationed in Belize (Central America), which also is part of the Commonwealth.

There is a subunit of British servicemen (up to 40 persons) on the island of Diego Garcia in the Indian Ocean, where the Americans, who created a large naval and air base there, are the proprietors.

According to data published in the foreign press, the overall strength of British troops stationed outside of Great Britain was almost 90,000 persons in 1988 (around 27 percent of the overall strength of the country's armed forces).

The UK military-political leadership, which is actively following imperialist policy, views military presence abroad as an effective means of strengthening its position in NATO, reinforcing influence in other parts of the world, and undermining progressive trends in developing countries.

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**Japanese 'White Book on Defense Issues'**  
18010378d Moscow ZARUBEZHNOYE VOYENNOYE  
OBOZRENIYE in Russian No 12, Dec 1988 (signed to  
press 7 Dec 88) pp 16-17

[Article by Col V. Rodin]

[Text] The Japan Defense Agency published the 1988 "White Book on Defense Issues" of Japan, approved by the Cabinet of Ministers, which gives an official assessment of the world military-political situation and sets forth basic directions of military policy for the near term. Beginning in 1976 the country's military department has published a "White Book" on these issues annually, but the appearance of the last one generated heightened interest both of Japanese and foreign specialists. It was prepared under conditions of a reduction in world tension which has begun to emerge because of development of a dialogue between East and West, and above all between the Soviet Union and United States of America. This factor was what determined the experts' approach to an analysis of the basic provisions published in the "White Book".

The first thing to which western specialists directed attention was the Japan Defense Agency's retention of previous stereotypes with respect to an estimate of the military-political situation and determination of the source of military danger in the world as a whole and in the Far East in particular. Having mentioned the Soviet-American INF Treaty and the Geneva Agreements on Afghanistan as if in passing, authors of the "White Book" as in past years directed primary efforts toward a crude distortion of Soviet foreign policy. While keeping silent about USSR initiatives aimed at destroying all kinds of nuclear weapons and reducing conventional weapons, they attempt to place responsibility for the continuing arms race on the Soviet Union and thus to substantiate the "need for the West and Japan to build up a military deterrent potential." As the progressive Japanese press notes in this regard, "despite obvious facts, the Japan Defense Agency gives the appearance that it does not notice changes in the international climate and continues to intimidate Japanese readers with a growth of military threat from the North."

The reasons for the Japan Defense Agency's adherence to decrepit stereotypes become clear after familiarization with those sections of the "White Book" setting forth basic directions of national military organizational development for the near term. A new concept is brought

to the fore here in preparing the Self-Defense Force for combat operations at so-called forward positions, taken to mean areas situated at a considerable distance from the Japanese islands. No secret is made of the fact that basic efforts are to be focused on the northern sector. Within the scope of this concept, it is envisaged establishing a major troop grouping on the island of Hokkaido in the northern part of the country and reoutfitting all branches of the Self-Defense Force with new modern models of weapons and military equipment. To this end in particular it is planned to concentrate over 50 percent of the entire Army tank inventory (more than 600 tanks) on the island of Hokkaido, outfit the Northern Army stationed here with cruise missiles having a range of over 100 km, and reorganize the combined-arms large units which are part of that army. In the Air Force it is planned to increase the number of ground attack aircraft and expand their combat radius by accepting tanker aircraft in the inventory. In the Navy it is planned to direct main efforts at outfitting naval forces and aviation with attack missile weapons and begin commissioning ships outfitted with the Aegis multifunctional weapon system.

Foreign specialists note that outfitting the Self-Defense Force with new kinds of weapons substantially expands the zone of its possible employment outside the Japanese islands and casts doubt on the leadership's officially proclaimed course toward the country's adherence to a "strictly defensive strategy."

A large place is set aside in the "White Book" for Japanese-American military cooperation, which is defined as the "cornerstone of Japanese military policy." Here the authors single out the following basic directions of the two states' interworking in this sphere: a further increase in the country's expenditures for upkeep of American troops on its territory, which in 1988 were around \$2.5 billion; activation of joint operational and combat training of the armed forces to practice plans of operations in a possible armed conflict in the Far East; expansion of military-technical cooperation, including Japan's participation in implementing the American "star wars" program; and activities to improve the infrastructure in the interests of the U.S. Armed Forces, including creation of arms depots for the deployment of contingents of American troops on the country's territory if necessary. As the newspaper AKAHATA notes in this regard, "a further increase is planned in Japan's role of implementing the American strategy of forward basing."

By admission of the "White Book" authors, implementation of current and future programs for military organizational development requires a constant increase in annual military expenditures. Therefore they not only justify the 1987 government decision to abolish the limitation on military appropriations (it was one percent of the GNP), but they also do not preclude that in the next few years Japan may take over one of the leading places in the world based on their level (some \$30 billion in 1988).

On the whole, as the foreign press notes, the contents of the "White Book" indicate that under conditions of a warming of the international climate which is beginning to show and the appearance of a trend toward a reduction of arms and military expenditures, the Japanese leadership is demonstrating a resolve to continue the course toward increasing militarist preparations, which causes natural uneasiness in peoples of countries of the Far East and Southeast Asia.

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### **Organization of Command and Control in the U.S. Army Division**

18010378e Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 12, Dec 1988 (signed to press 7 Dec 88) pp 19-23

[Article by Lt Col V. Borodayev, candidate of military sciences, and Lt Col A. Kuzvesov, candidate of military sciences]

[Text] In carrying out a broad set of measures to increase the firepower and striking power of large and small units, the U.S. Army command is giving great attention to improving their command and control elements, which have to provide direction of the troops in any situation regardless of the nature of combat operations with a sufficient degree of reliability, and more effectively than the enemy. Command and control itself is viewed by American military specialists as the art of commanders in directing troop operations and deliberately influencing subordinates. Its organization is based on a number of requirements by which the commander must be guided. Above all it is a high level of professional training of persons in authority, high-quality troop training, mutual understanding between the commander and his subordinate subunits, getting operation orders to executing entities swiftly, and so on. Only in this case will the commander function confidently in combat and expect self-starting execution of his will by subordinates.

The foreign press reports that the U.S. Army has no mandatory provisions in regulations on questions of command and control, which gives commanders at all levels a certain independence. But the commanders themselves have to master various methods of controlling fire and executing a maneuver, make skillful use of the terrain, know the principles of employing aviation and fundamentals of coordination with naval forces and assets, and skillfully combine the massing of fire and concentration of troops. Experience shows that the commander who is victorious is the one who knows and skillfully employs the forces and assets at his disposal.

It is emphasized that under present-day conditions with the increased complexity of command and control and an increase in the significance of the time factor, a division commander, who is granted the right of determining missions and issuing operation orders and

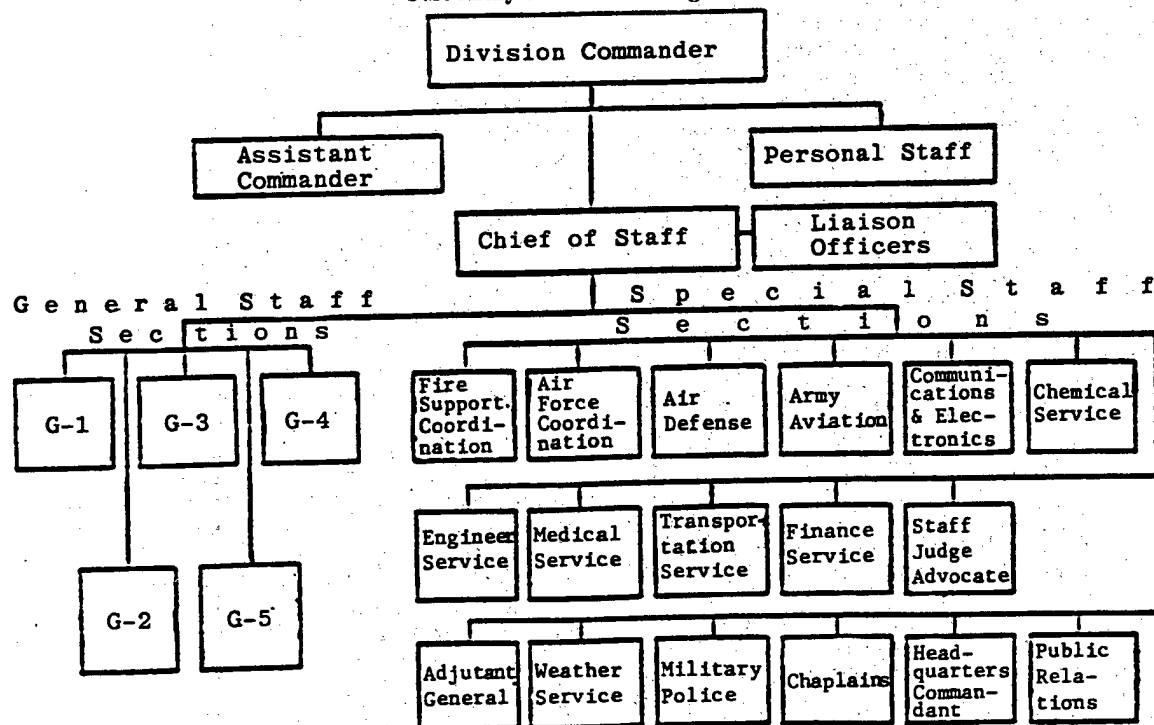
instructions on his own, cannot cope with his duties if he does not concentrate exclusively on deciding the most important command and control issues and does not rely on the staff and take advantage of its capabilities. Assistant division commanders also have powers of command and control in the division. One of them usually is assigned to decide operational matters and another to decide combat support matters. If necessary, the assistant division commanders can be used for command and control of task forces (such as screening forces, rear area defense forces, and other forces).

The division staff is the primary command and control element. It assists the commander in decisionmaking and executing missions assigned to the division. The staff exercises command and control in the course of combat operations, arranges coordination with attached and supporting units and subunits, provides the commander and subordinate units or subunits with necessary information on the enemy, performs a situation estimate, determines troop requirements for executing assigned missions, envisages possible options in the development of events and recommends the most acceptable of them to the commander, draws up plans and draft orders, and monitors subordinates' actions.

The division staff includes two parts (general and special), a personal staff, and liaison (coordination) officers (see diagram). It is headed by a chief of staff, who is responsible for all the work of the staff and its subunits in organizing command and control of staff and attached subunits and units. He directs the work of the staff toward accomplishing assigned missions, reacting promptly to the situation at hand, and drawing up proposals for the commander's decisionmaking. According to existing statute, the chief of staff is not an assistant division commander and his subordinate officers of the general and special staffs do not have the right to issue orders or instructions to lower commanders regarding execution of orders received from the higher command element. They can only express their recommendations and report suggestions to the commander who issued the order or instruction. It is, however, allowed and in some cases also recommended that the best trained staff officers be given the right to independently draw up plans and issue instructions in the name of the division commander. The division commander can include any team on the staff and conduct a necessary reorganization within limits of the organization and establishment.

Officers of subunits of the *general part* of the division staff are directly subordinate to the chief of staff and work under his direction. In some cases the division commander can work with them directly, bypassing the chief of staff. The functional duties of subunit personnel in the general part chiefly are the collection, processing, analysis and evaluation of data on the enemy and the situation with the objective of producing specific proposals in order for the commander to make an appropriate decision. The officers' work is arranged in close coordination with other staff subunits. Section chiefs are assistant chiefs of staff for the corresponding areas.

# U.S. Army division staff organization



The *special part* of the staff assists the commander in resolving a number of special, technical and other matters. It includes representatives (chiefs) of all combat arms and services of the division, who in a number of cases additionally are the commanders of combat and logistic support subunits as well as chiefs of corresponding services. That structure should facilitate a more efficient accomplishment of missions arising in the course of combat operations, more precise organization of coordination, and more flexible command and control.

The *division commander's personal staff* works immediately under his direction. This staff includes persons (specified by the establishment) with whom he personally works and whom he directs (particularly the aide-de-camp). In addition, the personal staff also includes persons who by their official position have special relations with the division commander (sergeant major, inspector-general, staff judge advocate and chaplain).

*Liaison officers* are representatives of the division commander. They can work under the immediate direction both of the chief of staff and of his assistant for operations, representing the commander on other staffs to ensure the coordination of operations and an exchange of the most important information.

According to the foreign press, the type structure of a division staff shown above meets requirements of the country's military leadership in the organization of command and control of units and subunits in the course of

combat operations. In particular, it is proposed to create the following command and control elements on the basis of the staff and other division subunits: forward command post [CP], main CP and combat operations control center [COCC], alternate CP (usually division artillery headquarters) and if necessary a rear CP; in the brigade a forward CP and main CP, and an alternate CP may be designated. The main requirement which American military specialists place on control elements is the capability of providing command and control in any situation regardless of the nature of combat operations.

The *forward CP* is formed basically from personnel and equipment of the division staff operations and intelligence sections. It also includes representatives of other staff subunits: personnel and logistic sections, fire support coordination section, Air Force coordination section, air defense coordination section and others. There can be a total of some 30 persons and up to 20 special vehicles at the forward CP. That makeup permits the forward CP to execute a swift displacement, which is dictated by the development of combat and determined by decision of the division commander. The forward CP is located 4-6 km from the forward edge of friendly troops, which permits the division commander to influence the course of battle directly and promptly. Communications from the forward CP is maintained with all first echelon subunits and with the division main CP and COCC. Chief of the operations section (assistant chief of staff for operations) is responsible for work of the main CP. In addition to directing current combat operations,



the forward CP must accomplish such tasks as organizing the collection and immediate use of information, exercising command and control of mobile forces and of close fire support, coordinating operations of tactical aviation and air defense weapons and so on.

The **main CP** also is formed of division staff subunits. Structurally the main CP can include the following subunits: sections (operations, intelligence, personnel, logistics, coordination of air space use, which includes representatives of air defense and army aviation, chemical service, and others as necessary), groups (for fire support coordination, support of the division COCC), and teams (tactical air control, which includes representatives of the staff section for coordination with the Air Force, terrain reconnaissance and others). Other assigned personnel, representatives of combat arms and services, also can be included for work at the main CP. There can be a total of up to 150 persons and over 70 vehicles of various types at the CP.

The main CP is situated behind combat formations of first echelon brigades 8-12 km from the forward edge of friendly troops. Its work is controlled directly by the division chief of staff. The COCC is the basic component of the main CP. That makeup of the main CP must facilitate organization of more precise coordination of forward and rear division subunits and units. If a forward CP is not deployed in the division, functions of command and control over the course of combat operations rest with the main CP. The main CP may displace in stages or all at once. Continuous communications with first echelon troops, the forward CP and the higher command authority is organized with deployment of the main CP. It is believed that the division main CP must support current combat operations and in addition generalize necessary information in the commander's interests, organize combat support of troops, prepare and dispatch reports, generalize and process intelligence, coordinate rear area defense operations, plan upcoming combat operations and maintain constant communications with the corps main CP.

The **alternate CP** can be established by order of the division commander for providing command and control during a displacement of the main CP or in case the main CP has lost the capability of command and control as a result of action by enemy weapons. The staffs of division subunits and units also can be used as alternate CP's. The missions of this control element will be determined by conditions of the combat situation.

Personnel of appropriate staff subunits and the support command (a total of some 130 persons and over 60 vehicles) are brought in to work at the **rear CP** (deployed in the division rear area). It is responsible for accomplishing missions of organizing supply, technical, medical and other kinds of support to the troops. The rear CP is headed by one of the assistant division commanders.

In the assessment of the U.S. Army command, the existing system of command and control elements permits efficiently accomplishing missions arising in the course of combat operations and promptly getting appropriate instructions to subordinates. At the same time it is emphasized that the work of command and control of subunits and units will be very difficult without the cohesive work of all division staff subunits, precise knowledge of their functional duties, and precise determination of the purpose of each of them.

Below is more detailed information about specifically just what is done by particular subunits and representatives of other combat arms and services included in the above control elements.

**Operations section.** Allocation of personnel to CP's depends on missions to be accomplished: command and control of subunit and unit combat operations at the forward CP, and combat support at the main CP. In the first instance the operations subsection (part of the operations section) will exercise supervision over progress of mission accomplishment, estimate the friendly troop situation, and prepare operations estimates, operation instructions on executing a maneuver, and a number of others, as well as proposals for use of additional forces and assets. A similar subsection at the main CP will monitor progress of combat operations and coordinate use of available forces and assets in the interests of combat support. In addition, the personnel prepare operation plans; receive, process and approve requests for close air support; coordinate measures for redeployment of troops; work up recommendations for employing nuclear and chemical weapons and conducting electronic warfare and psychological operations; and prepare reports to higher headquarters.

The **intelligence section** has the bulk of its personnel at the main CP. It decides questions of planning, organizing, collecting and analyzing intelligence; compiling and distributing information documents on the organization of air and ground reconnaissance; and other questions. The information received is disseminated to all interested echelons.

The **personnel section** is located at the main and rear CP's. Its representative also may be at the forward CP, in which case he is responsible for informing the division commander about personnel losses and informing his superior about progress of combat operations. The section at the main CP keeps a record of personnel who are out of action and the section at the rear CP is responsible for replacements for units and subunits.

The **logistic section** is deployed at the main and rear CP's and sends its representatives to the forward CP to assist the commander and assigned forward CP personnel in matters of logistic support and in working up appropriate suggestions. At the main CP section personnel work chiefly on coordinating questions of logistic support to



combat operations; at the rear CP they are responsible for organizing logistic support (performing repair and servicing of combat equipment, organizing transport movements and so on).

The **military civil affairs section** usually is at the rear CP and is responsible for organizing the command element's contact with civilian authorities and the populace in a zone of combat operations.

Personnel of **special staff sections** of the division staff are distributed to control elements so as to ensure reliable coordination of all division units and subunits in the course of combat operations. It is emphasized that to achieve greater command and control efficiency the forward CP and main CP may include only those appointed persons of these sections who will be needed for a period of battle. As a rule, the others are at the rear CP, where the division commander's personal staff also is located.

The **division COCC support group** is formed by forces and assets of the reconnaissance and EW battalion and is intended to assist the operations and intelligence sections of the staff in accomplishing tasks of reconnaissance, EW and operational camouflage, concealment, and deception. It has the following subunits (sections): direction and assignment of intelligence collection; processing information on the enemy; analysis of counter-intelligence data; EW; supporting operational camouflage, concealment, and deception; and others. American military specialists assume that establishment of this element will promote a more thorough study of the enemy and possible nature of his operations, and in the final account it will promote timely decisionmaking by the division commander.

The **tactical air control team**, intended for arranging coordination with tactical aviation forces and assets supporting the division, is established on the basis of the division staff section for coordination with the Air Force. It accomplishes missions of assisting the division commander in planning air support of units and subunits and it coordinates tactical air strikes with the fire of ground weapons. In the latter instance it works closely together with representatives of the fire support coordination section.

American regulations note that the commander must be where he is capable of estimating the situation at hand most correctly, making a decision promptly, and ensuring command and control over his forces' combat operations. This is dictated by the dynamics of modern combat and by its inherent fast-moving nature and complexity, which in the final account requires a high level of organization of the work of all subunits of CP's at all command and control echelons. To this end each CP must be manned for around-the-clock work, and their outfitting must provide for continuous receipt of data on the enemy with the objective of getting it to interested echelons, units and subunits promptly.

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#### **UK Army Special Forces**

18010378f Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 12, Dec 1988 (signed to press 7 Dec 88) pp 23-26

[Article by Col S. Anzherskiy]

[Text] In plans for military preparations the British command pays special attention to comprehensive improvement of UK Army special reconnaissance personnel and resources, called the SAS (Special Air Service). It numbers up to 2,000 persons.

The foreign press reports that special reconnaissance is organized and conducted to undermine the political, economic, military and moral potential of a probable or existing enemy. Its principal tasks are to collect intelligence about the most important economic and military installations, destroy them or put them out of action, conduct psychological operations to demoralize the enemy personnel and populace, organize sabotage, commit subversive and terrorist acts in the deep enemy rear, inspire riots and rebellions, put together and train rebel formations, disinform and deceive the enemy, free friendly servicemen from imprisonment, take part in counterinsurgency operations, as well as fight terrorism, free hostages and guard highly placed persons. Some of these missions are assigned to special forces intended basically for conducting reconnaissance and sabotage operations and other acts of a subversive nature in the deep enemy rear.

**Organization.** The first special-purpose detachment was activated in the Army in 1941. During 1942-1943 two regiments were established on its basis, and in 1944 a separate special-purpose brigade was formed on their basis which took part in supporting Operation Overlord for landing Anglo-American troops in Normandy. After the end of World War II this brigade was disbanded, but the powerful upsurge of the national liberation movement and disintegration of the British colonial system in postwar years forced the British command to return to activation of special-purpose units and subunits. In the postwar period they took an active part in practically all operations of British troops to suppress national liberation movements in the Near East, Southeast Asia and East Africa, as well as in the period of the Anglo-Argentine military conflict over the Falkland (Malvinas) Islands.

At the present time, judging from foreign military press materials, the Army order of battle includes three special-purpose regiments (21st, 22d and 23d, stationed in London, Hereford and Birmingham respectively). They were activated in 1947, 1952 and 1959. The 22d Regiment is fully manned and one of its companies is

constantly in full combat readiness. The 21st and 23d regiments are at cadre strength; their unit-assigned reservists train in the training centers of these units.

A special-purpose regiment consists of a headquarters, 4-6 reconnaissance-sabotage companies, a signal company (4-6 platoons) and a support company. Three personnel training centers are established on the regiment's basis for basic, parachute and special training.

The reconnaissance and sabotage company (78 persons, of whom 6 are officers) includes a headquarters team and four platoons—parachute, amphibian, mountain and mobile, each of which has one officer and 15 NCO's and privates. Platoons are subdivided into operation teams of four persons each (commander, deputy commander, radio operator and scout). The regiment has a total of 600-700 persons and the following arms: 9-mm submachineguns, 5.56-mm automatic rifles, grenade launchers, mining equipment, collapsible boats with 40 hp motor, and other special equipment and gear.

Promptness and surprise are the basic principles of tactical employment of special-purpose units and subunits. The insertion of reconnaissance-sabotage teams into the enemy rear is planned to be done from aircraft, helicopters, submarines and surface combatants and with the use of hang gliders, balloons and other means. Subunits can operate by platoon or as part of operation teams depending on the nature of the assigned mission, conditions of the combat situation and the terrain. The principal forms and methods of their tactical employment consist of raids, hit-and-run attacks, ambushes and sweeps.

**Manning and training.** According to western military press reports, recruitment of personnel for special-purpose units is done twice a year on a volunteer basis from among Army and Air Force officers, NCO's and privates. Candidates undergo a thorough selection in connection with the special complexity of missions assigned to these subunits. Great importance is attached to their political reliability and motives for choosing this military specialty. The British command constantly emphasizes that service in special-purpose units is honorable and romantic, provides diversified training, and is well-paid (pay is considerably higher than for servicemen of other Army units and subunits). Personnel of special-purpose units are considered the elite of the British Armed Forces, but in contrast to formations of other arms of the Army these units and subunits do not have special distinctive marks on the uniform with the exception of an emblem consisting of a silver dagger with the inscription: "Who dares wins." It is worn as a badge on the beret (Fig. 1 [figure not reproduced]).

Candidate selection includes five stages during which they undergo a check of mental abilities, physical endurance, general military training, determination, quick thinking, resourcefulness and other morale and aggressiveness qualities. In external characteristics a candidate

must have medium height, European facial features without special distinctive marks, and a strong build, but tall servicemen are chosen for subunits assigned to provide security for highly placed persons.

In the first phase lasting ten days there is a check of general physical training, knowledge of military topography and an ability to orient oneself on different terrain. The check of physical training includes in particular a 2.4 km crosscountry run in field uniform (the norm is 12 minutes). In the second phase (also ten days) the candidates' endurance is checked in making a forced march over varying terrain with a daily increase in loads. Classes begin at 0400 hours and end with a critique at 2230 hours. The final test is a forced march of 64 km over rugged terrain with full combat gear wearing 25 kg overall (control time 20 hours). The third phase (14 weeks) includes training and checking personnel in tactical, reconnaissance and fire training as well as military topography as applied to forms and methods of operations of special-purpose subunits. In the fourth phase (approximately 40 days) there is parachute training and low-altitude parachute jumps. In the fifth phase (three weeks) there is training and a check of candidates' abilities to survive under extreme conditions and an evaluation of their ability to operate under special conditions (forays into the "enemy" rear, pursuit of the "enemy," organization and execution of escape from "imprisonment"). After each phase candidates who have not passed prescribed tests are dismissed (on the whole there is an 80 percent washout).

Personnel who have withstood all ordeals are sent to the training center of the 22d Special-Purpose Regiment for training lasting 15 weeks. For 3-4 weeks there are classes in tactical, reconnaissance, motor vehicle, mountain climbing, medical and physical training (including combat sambo and karate), demolitions, military topography and communications, and they study all factors connected with the use of weapons of mass destruction. In this period trainees make lengthy motor marches with orientation on unfamiliar terrain, they take diving training, and they learn to operate canoes, scooters and other special-purpose transport equipment (Figs. 2 and 3 [figures not reproduced]). Classes are held both with individual servicemen and with teams and platoons.

Weapon training (up to six weeks) includes the study of small arms and other armament of national production as well as foreign models. Each trainee is allocated 1,500 cartridges for practicing special firing exercises. For example, one exercise is to burst into premises captured by a "group of armed persons" (in reality mannequins) and destroy them by pistol shots (13 cartridges are allocated). Each target must be hit by two bullets in the chest area from a distance of at least 18 m.

The course for survival under extreme conditions is held for three weeks on varying terrain in summer and winter near the city of Exmoore. Radio training, which includes the study of Morse code and operation of high-speed

portable radios, takes up three months. During parachute training scouts make up to 40 jumps day and night from various altitudes with gear weighing up to 50 kg overall.

One foreign language (for example, Arabic, Russian or German) is studied throughout the training. Each training course ends in a quiz. The overall time of a scout's training is around two years. Servicemen enrolled in special-purpose units initially sign contracts for three or more years. After three years of duty they can return to their own units at their desire.

As the foreign press reports, combat training of special-purpose units and subunits is organized and conducted in accordance with requirements of the Army command for their more effective use in different regions. In particular, personnel periodically work operational training missions in Arctic areas of Northern Norway, in mountainous desert terrain, and in jungles on territories of British Commonwealth countries. In wartime Army special-purpose units are transferred to the reserve of the NATO Supreme Allied Commander Europe.

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#### **Future West German Field Artillery Automated Fire Control Systems**

18010378g Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 12, Dec 1988 (signed to press 7 Dec 88) pp 26-33

[Article by Col S. Sergeyev, candidate of military sciences]

[Text] The Bundeswehr command places great emphasis on developing an automated field artillery fire control system. This is dictated above all by the fact that, in the opinion of West German military specialists, in the foreseeable future artillery will remain the principal kind of weapon for engaging targets in the forward area of the combat zone. The makeup and number of potential targets are determined both by missions assigned to artillery and by its fire capabilities. The primary field artillery missions are as follows:

—Close support of troops on the battlefield and engagement above all of armored targets and elements of the opposing side's reconnaissance and command and control systems;

—Engagement of enemy artillery and division second echelons as well as forward army groups when they enter the artillery's effective zone.

In addition, artillery has to partially carry out the destruction of tactical air defense weapons and logistic support installations. It is believed that the proportion of artillery targets in the forward area of the combat zone can reach 70 percent.

The next important reason dictating the need for automating field artillery fire control is a change in the nature of modern combat operations, consisting of their greater mobility and fluidity. As the foreign press notes, under these conditions it is impossible for artillery to effectively accomplish its missions without automating the artillery fire control process.

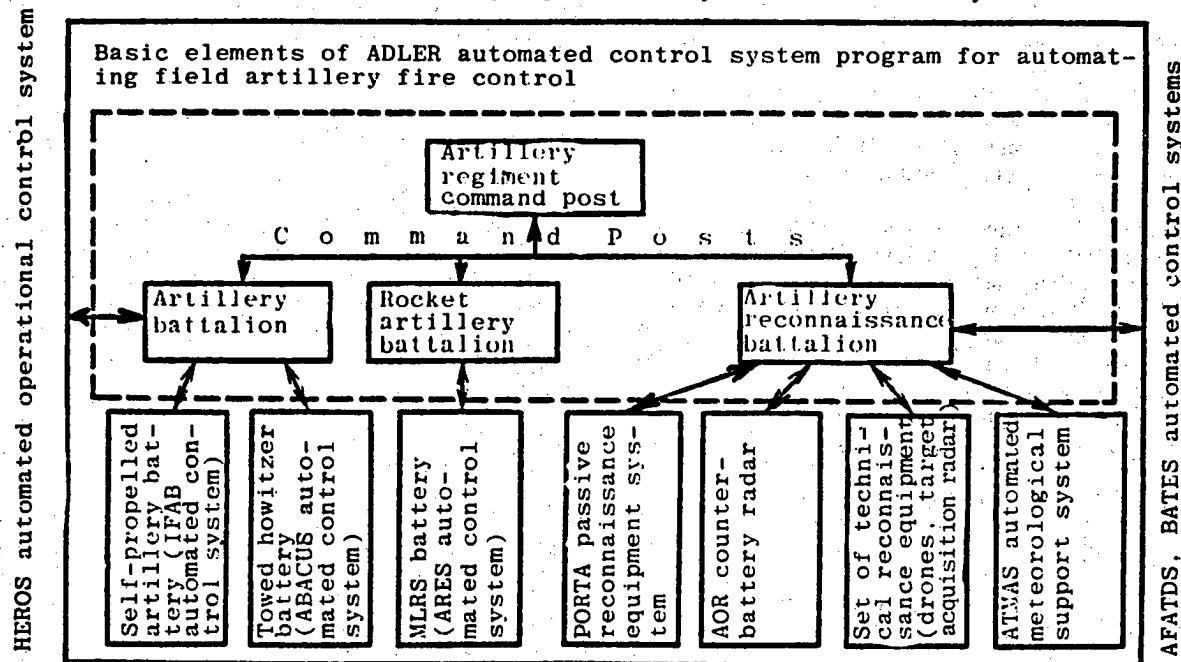
High efficiency in executing combat missions is the primary requirement which the Bundeswehr command places on a future field artillery fire control system. Along with measures of an organizational nature necessary for achieving this, measures are being taken for corresponding technical support. The primary role here rests with realization of a program for developing an automated field artillery fire control system known as ArtFuInFELSys (Artillerie-Führungs-Informations-und Feuerleitsystem). It is planned to have this automated control system support artillery subunits and units intended for employment in the army corps zone. It is presumed that the system must provide for automated collection, processing and display of information needed for control elements to function; planning fire (including elaboration of possible options) with optimum distribution of artillery personnel and resources in place and time with consideration of different kinds of ammunition; and identifying the need for redeploying artillery units and subunits and appropriate logistic support missions.

The future army corps field artillery fire control system functionally will unite a number of automated control systems being developed under several interrelated projects (Fig. 1). It is planned to ensure its functional coordination with the FRG Army operational control information system that is being developed, known as HEROS—Heeres-Führungsinformationssystem für die rechnergestützte Operationsführung in Stäben), and its interface with such army field artillery automated fire control systems of some NATO countries as TACFIRE and AFATDS (USA), BATES (UK) and others. According to western press reports, the ADLER (Artillerie-Daten-Lage und Einsatz-Rechnerverbund) automated control system is to become the central element of the FRG army corps field artillery fire control system being developed.

The ADLER automated control system is intended for controlling field artillery subordinate to the division. The basic equipment, which includes a computer, programmer, external magnetic disk storage, two data I/O devices, printer and radio communications equipment for data transmission, is to be accommodated at command posts of the artillery regiment and artillery battalions (tube artillery, rocket artillery, and reconnaissance battalion).

This automated control system and its basic components have standard gear. It is to be installed in two types of bodies. For example, command posts of the artillery regiment, rocket artillery battalion and reconnaissance

Fig. 1. Composition and structure of future army corps field artillery automated fire control system of the FRG Army



battalion are accommodated on 5-ton vehicles (with trailer), and those of field artillery battalions are on 2-ton vehicles (with trailer). Redundancy of primary system centers (command post equipment) and their displacement in two echelons is planned in order to provide stable command and control of artillery units and subunits. Radio communications equipment supports data transmission in digital form. Radiotelephone can be used as a reserve net.

When this system was being developed there was a study of problems of collection and initial processing of information at all echelons of the artillery regiment; information flows from various subunits were systematized and coordinated; information processing methods were developed; and tasks to be accomplished by man and by machine were delineated. In the opinion of West German specialists, technical capabilities of the equipment being developed should ensure high efficiency of the control process at all stages of system functioning. The ADLER automated control system can be created in its complete makeup by the end of the 1980's. Individual components presently are undergoing field testing. It is believed that automating field artillery fire control by making this system operational will permit raising the effectiveness of an artillery battalion's fire by 60 percent.

It is planned that systems for fire control of tube and rocket artillery as well as a field artillery non-visual target acquisition system will be the basic functional elements of the ADLER automated control system. Three automated systems presently are being created: the IFAB (Integrierten Feuerleitmittel Artillerie—Batterie) for the 155-mm self-propelled howitzer battery,

ABACUS (Artillerie—Batterie—Computerunterstützte System) for the 155-mm and 203.2-mm towed howitzer battery, and ARES (Artillerie—Raketen—Einsatz—System) for the MLRS battery. The first automated control system mentioned saw greatest development of these systems. It includes a battery fire control element, mobile artillery observation post, and battery artillery survey vehicle.

The *battery fire control element* consists of the commander's control element and a data processing element. The former is set up in a half-ton vehicle, which accommodates the DEA data I/O device with buffer storage for 64 alphanumeric symbols, radio communications equipment, and a place reserved for the ADLER automated control system terminal. The data processing element is equipped with the Falke TR-84 computer (with a speed of 200,000 operations per second and working storage size of 32,000 18-bit words), three I/O devices (two DEA 64 and one DEA 24F), a printer, radio communications equipment and monitor accommodated in an M113A1 tracked APC (Fig. 2 [figure not reproduced]). The Falke computer will be replaced by a standard Type MR 8020 computer when the system is fully deployed.

The *mobile artillery observation post* (Fig. 3 [figure not reproduced]) is intended for accomplishing missions of battlefield surveillance, target acquisition, determination of target coordinates and providing coordination with supporting subunits. Observation post equipment is accommodated in the M113A1 APC and includes a PERI D-11 360° periscopic panoramic sight with built-in laser rangefinder, DEA 64 I/O device together with

computer, radio communications equipment, navigation gear and monitor. There is a crew of four. There were 320 such vehicles delivered for the Bundeswehr.

The battery *artillery survey vehicle*, intended for determining gun coordinates, is equipped with navigation gear, optical rangefinder, DEA 24F I/O device, radio communications equipment and monitor.

According to foreign press reports, the IFAB automated control system is used as follows. When the system deploys on the terrain the mobile artillery command post team uses the navigation gear to determine their coordinates and uses the rangefinder and navigation gear computer to determine the coordinates of each piece set up at the firing position. The survey vehicle's DEA 24F I/O device is used to provide calculated firing position coordinates to each piece, where they are displayed on the screen of the gun team commander's DEA 64 I/O device. Survey vehicle data also are transmitted to the battery fire control element and entered in the computer. The process of tying in one piece takes 15 seconds, and tying in the entire battery takes no more than two minutes. Accuracy of determining position coordinates is no more than 10 m.

Artillery fire is planned and possible options developed at the battery fire control element in accordance with the battery commander's directions received from the control element. Initial data needed for this (target coordinates received from the mobile artillery observation post, data of the topographic survey of pieces from the mobile artillery observation post, kind of ammunition and so on) are entered in the computer by the battery fire control element operator using the printer keyboard. Firing data calculated by the computer and corresponding to the selected fire option are entered in the DEA 24F I/O device by the operator and transmitted over digital communication channels to the firing positions, where they are displayed on the DEA 24G I/O device screen for execution of functions by the gun teams. Fire is opened on receipt of the appropriate order of the battery commander.

This procedure for the functioning of system elements corresponds to the option of its combat employment when firing against planned or newly reconnoitered stationary targets. When conducting fire against mobile targets, the necessary increase in system promptness is achieved by entering the coordinates of targets received from the observation post in the battery fire control element computer directly from the DEA 64 I/O device.

In the opinion of West German military specialists, results of field testing of the IFAB automated control system confirmed the correctness of the system concept and its conformity to modern demands.

This automated control system has higher mobility in comparison with existing systems. For example, it takes two minutes to deploy the observation post and three

minutes to prepare it for movement. In addition to ensuring mobility, use of the M113A1 APC as the transportation base on which equipment of the mobile artillery observation post, battery fire control element, and battery artillery survey vehicle is accommodated also permits reducing system vulnerability to active enemy weapons.

Automating the field artillery fire control process permits substantially increasing system operational capabilities. For example, based on field testing data the effectiveness of fire conducted by an artillery battery increases 40 percent just by using digital data transmission methods, by increasing the accuracy of determining target coordinates and by reducing the time for performing necessary calculations.

The *ABACUS automated control system*, intended for fire control of the 155-mm and 203.2-mm towed howitzer battery, is in the final stage of development. Its structure and makeup are similar to the IFAB system, the difference being in the software used. In addition, at the present time the question of outfitting artillery observers with appropriate automation equipment has not yet been decided. Data are being transmitted from them to the battery fire control element in a radiotelephone mode.

The *ARES automated control system* will provide fire control for an MLRS battery. At the present time the system concept has been developed and possible versions of its realization are being studied. The basic direction is an increase in effectiveness of tactical employment of existing and future MLRS's. Structures of the ARES system differ for the LARS MLRS in the inventory and for future MLRS's. In the LARS, fire is controlled from the battery fire control element through the launcher control element set up in the hut of the FERA field artillery radar fire control system (Fig. 4 [figure not reproduced]). The MLRS launchers will be controlled directly from the battery fire control element. For this it is planned to outfit them with the appropriate equipment (DEA 1000 I/O device, SEM 90 radio). It is proposed to accommodate the launcher control element in a half-ton vehicle.

The ARES system battery fire control element for future MLRS's is to be accommodated in a 2-ton vehicle. It is planned to include the MR 8020 computer, two DEA 2000 I/O devices, three SEM 90 radios, a printer, as well as a monitor in the equipment. The difference in the battery fire control element for batteries of different types of rocket artillery will lie in the software.

To improve the stability of battery fire control when the control element is out of action, there is a capability of transferring its functions to the neighboring battery's fire control element. It is planned to include a processor, which performs mutual conversion of data formats being

used, in the battery fire control element to provide an interface for the ARES automated control system with future MLRS's of other NATO countries.

In the opinion of West German military specialists, effective employment of all kinds of artillery is impossible without reliable knowledge of enemy forces and assets. Therefore tactical employment of automated field artillery fire control systems will be based on close coordination with the artillery reconnaissance system.

The **artillery reconnaissance system** is one of the principal components of the ADLER automated control system and is intended for collecting and processing reconnaissance data and distributing the information received. It is planned to collect data from ground radar and from visual and sound ranging resources as well as by using reconnaissance drones. It is planned to transmit reconnaissance data received from these resources over digital communication channels to the artillery reconnaissance battalion CP for initial processing, and then to the artillery regiment CP, where it is generalized and compared with that received from other sources supporting the HEROS system. Reconnaissance information on targets earmarked for destruction is provided to the appropriate artillery subunits using ADLER system equipment.

The **artillery reconnaissance system** will consist of a set of PORTA (Passiven Ortungsmittel Artillerie) passive equipment, AOR (Artillerieortungsradar) counterbattery radars, a set of AufklMH (Aufklärungsmittel Heer) technical reconnaissance equipment and the ATMAS (Atmosphärisches Mess- und Auswertesystem) automated meteorological support system.

The SMA (Schallmessanlage) 085 Series 1 sound ranging reconnaissance subsystem, OZA (Optronische Zielortung Artillerie) opto-electronic reconnaissance equipment subsystem, and data transmission equipment are to be included in the set of PORTA passive reconnaissance equipment.

The *SMA 085 Series 1 sound ranging reconnaissance subsystem* is intended to replace the SMA 064 subsystem in the inventory (in the early 1990's). It includes ten sound ranging reconnaissance stations and a data processing station. The sound ranging reconnaissance station is mounted on a half-ton vehicle. Its equipment includes a set of sensors (four microphones); electronic data processing equipment using a microprocessor; data transmission equipment (based on the SEM 90 radio); and power sources. The data processing station is accommodated on a 5-ton vehicle; its equipment includes the MR 8020 computer, I/O device, printer and radio communications equipment.

Positions of the SMA 085 system stations are situated in an area 10 km wide and 5 km deep and provide a reconnaissance zone 25 km wide and up to 18 km deep. Coordinates of enemy tube artillery firing positions are

determined by triangulation. It is planned to equip the sound ranging reconnaissance subsystem with expendable sounding balloons to increase the range for reconnoitering artillery targets and provide capabilities for reconnoitering rocket artillery positions. A special 155-mm cluster projectile is being developed for this purpose. The modernized sound ranging reconnaissance subsystem will be designated the SMA 085 Series 2.

The *OZA opto-electronic reconnaissance equipment subsystem* is intended for determining enemy artillery firing position coordinates based on receipt of direct IR band signals or those reflected in the atmosphere which arise when guns fire. It can include up to eight measuring stations (each on a half-ton vehicle) and a data processing station with equipment accommodated on a 5-ton vehicle. The measuring station includes a mosaic-type receiver, microprocessor and data transmission device (based on the SEM 90 radio). Data on the direction of a detected signal, time of detection and station number go to the data processing station from each measuring station. Artillery position coordinates are determined by triangulation. Reconnaissance information obtained using ADLER automated control system data transmission equipment will be transmitted to the artillery reconnaissance battalion CP and compared with information received from other sources.

The *future AOR counterbattery radar* with phased array is being developed to replace the Green Archer radars in the 1990's. It is assumed that radar positions will be 5-10 km from the front line. Up to two radars of this type may be in the division zone. A determination of enemy artillery firing position coordinates performed at the data processing element using the computer is based on prediction of the flight trajectories of detected projectiles. Reconnaissance information is transmitted from that element to the artillery reconnaissance battalion CP by radio.

The **AufklMH technical reconnaissance equipment set** is to include, along with the radar, the CL-289 drone and KZO (Kleinflugkörper für Zielortung) small flying craft. The CL-289 reconnaissance drone is intended for detecting various targets, including artillery positions, in the depth of the enemy force grouping in the division and army corps zone. Targets are detected in the visible and IR bands. The small KZO craft will be used for determining the location of detected targets and for giving target designation to tube and rocket artillery weapons. Both types of drones are outfitted with equipment for programmed flight control and a system for radio data transmission which interfaces with the ADLER automated control system to ensure promptness of reconnaissance. According to foreign press announcements, depth of reconnaissance using drone data reaches 75 km.

The set of technical reconnaissance equipment in the FRG Army also includes the RATAC and Rasit ground target acquisition radars. To increase the effective range

of radars it is planned to install them in aircraft, helicopters, and special tethered platforms. At the present time the FRG has developed the ARGUS reconnaissance system, which includes the Do-34 Kiebitz tethered platform fitted with a ground target acquisition radar and ELINT gear.

The ATMAS automated meteorological support system is planned to be used in the interests both of artillery units and subunits and of tactical air defense as well as units and subunits providing protection against weapons of mass destruction. It is proposed to periodically transmit meteorological data over radio in a semiautomatic mode. The basic equipment of the ATMAS system is to be accommodated in a 5-ton vehicle.

The functioning of the field artillery automated fire control system when using reconnaissance data from forward artillery observers and artillery reconnaissance system equipment has certain features. The procedure for functioning of the IFAB automated control system examined earlier on the whole also is suitable for the other systems. Data from forward artillery observers are transmitted simultaneously to the battery fire control element and the artillery battalion CP, where they are checked, compared with data from other sources, evaluated and entered in the situation data file. Here, using ADLER automated control system software, the necessary calculations are made for substantiating possible field artillery tactical employment options. If it is necessary to engage all planned targets and there is a shortage of battalion resources for this, appropriate data are transmitted to the artillery regiment CP. In decision-making for reinforcement, data on targets earmarked for engagement are transmitted from the artillery regiment CP to the CP of the primary battalion and the reinforcing battalion, then to the battery fire control elements. Forward artillery observers monitor target engagement. Data on destroyed targets are transmitted to the CP's of the artillery battalion and of that portion of the ground forces being supported.

Use of technical reconnaissance equipment provides the opportunity, with the onset of combat operations, to detect, for example, enemy artillery positions which had not been reconnoitered before this. Corresponding data are transmitted from the technical reconnaissance equipment to the artillery reconnaissance battalion CP, where they are checked and compared with data from other sources, then transmitted to the artillery regiment CP for decisionmaking. Effectiveness of engaging the artillery targets detected in this case is evaluated by the technical reconnaissance equipment.

In the opinion of West German military specialists, adoption of the future automated field artillery fire control systems and artillery reconnaissance control systems will improve the operational capabilities of corresponding units and subunits. For example, the time for planning fires in the battalion will be reduced from 2-3 hours to 30 minutes; the time from target acquisition to

opening fire will be reduced from 8-15 minutes to 2-3 minutes; and the time for opening fire against detected targets will be reduced from 2-3 minutes to 30 seconds.

Completion of work to create the automated field artillery control system in the FRG to the full extent will make it possible to approximately double fire effectiveness. On the whole, realization of a program for automating field artillery fire control and the comprehensive use of personnel and equipment will permit substantially increasing the operational capabilities of the system being created for controlling ground combat operations, with the system's most important component being the field artillery automated fire control system.

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#### **Austrian Armored Equipment**

1801037h Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 12, Dec 1988 (signed to press 7 Dec 88) pp 33-36

[Article by Col Ye. Viktorov, under rubric "At the Readers' Request"]

[Text] Austria is a neutral state. The Army is the basis of its Armed Forces. In addition, there are Air Force units and subunits. Austrian industry produces various arms which both go to outfit its Army and are exported to other countries. Production of small arms and artillery and models of armored equipment holds a significant place. The firm of Steyr-Daimler-Puch is considered the chief developer and manufacturer of armored equipment. It produces light tanks, tracked and wheeled APC's, as well as vehicles for various purposes created on their base.

The inventory of the tank battalions (three, part of mechanized infantry brigades) consists of American M60A1 (120) and M60A3 (50) tanks. Antitank subunits in particular are outfitted with SK-105 Kürassier light tanks (250). In addition, the Army has some 460 4K 4FA tracked APC's. A modernized version of this APC, the 4K 7FA, presently is being produced. Steyr-Daimler-Puch is prepared for series production of the Pandur wheeled (6x6) APC. Austrian specialists also have created a prototype of the OAF wheeled combat reconnaissance vehicle.

The SK-105 Kürassier light tank (Fig. 1 [figure not reproduced]) initially was developed by the firm of Saurer-Werke, which merged with Steyr-Daimler-Puch in 1970. The 4K 4FA tracked APC created in the late 1950's served as the base. Series production of the SK-105 Kürassier light tank began in the early 1970's. Some 600 tanks were produced up to 1985, of which 250 went to the Austrian Army and the others were purchased by Argentina (150), Bolivia (34), Morocco (109) and Tunisia (54).



The tank hull is welded. Its frontal armor (20 mm thick) provides protection against small caliber projectiles. The driving compartment is in the forward part of the hull and the engine-transmission compartment is in the rear.

The tank uses a modified FL-12 two-place oscillating turret of the French AMX-13 light tank. It consists of two parts: a lower part mounted on a ball race and an upper oscillating part in which the CN 105-57 105-mm rifled gun and coaxial 7.62-mm machinegun are mounted. A semiautomatic loader with two magazines of six ready-to-use rounds each provides a rate of fire of 12 rounds per minute. The tank has a crew of three.

The gun is not stabilized, but a rather high first round hit probability on a stationary target is achieved by using a laser rangefinder when firing from the halt. The unit of fire includes 43 rounds with shaped-charge, HE-fragmentation and smoke projectiles. The French-developed OFL 105GI fin-stabilized armor-piercing discarding-sabot projectile was included in the unit of fire in late 1985. This projectile, which has a muzzle velocity of 1,460 m/sec, penetrates a standard NATO target consisting of three armor plates at a distance of 1,000 m. Triple-tube grenade launchers are mounted along the sides of the turret for laying smoke screens.

A six-cylinder diesel engine and mechanical transmission are installed in the tank. The engine-transmission compartment is equipped with an automatic fire extinguishing system. The running gear has torsion-bar suspension, with hydraulic shock absorbers on the first and fifth road wheels. The tank is equipped with a heater for manned compartments and with communication equipment.

According to foreign press announcements, Austrian specialists began modernizing the SK-105 Kürassier light tank in the early 1980's. As a result the SK-105/A3 version was created by 1986, on which the American M68 105-mm rifled gun, stabilized in two laying planes, was used as main armament (as on the series M60 tanks). The unit of fire consists of 32 rounds. Gun laying drives are electrical. The fire control system includes a digital ballistic computer. Passive night vision devices are installed for the gunner and commander. In addition, armor protection of the frontal part of the welded turret was reinforced.

The Greif armored recovery vehicle and an engineer vehicle were created on the basis of the SK-105 Kürassier light tank. The first is equipped with a rotary hoisting crane (maximum lifting capacity 6.5 tons), main and auxiliary winches (20 and 1.44 tons tractive force respectively), and a spade which is attached to the front of the hull and is used for excavation or in extricating stuck light armored vehicles.

The 4K 4FA tracked APC (Fig. 2 [figure not reproduced]) was created in the early 1960's on the basis of an earlier model, the 4K3H. The APC's enclosed armored hull

protects against small arms fire and fragments of artillery and mortar projectiles. The frontal armor is 20 mm thick. The driving compartment is in the front left part and the power plant is on the right. The assault compartment accommodates eight fully equipped infantrymen.

The APC is armed with a 12-mm or 7.62-mm machinegun. There is a version of the APC on which a single-place turret with 20-mm automatic gun is mounted.

The 4A 4FA APC uses a six-cylinder diesel engine and mechanical transmission. The running gear has torsion-bar suspension. The APC is nonamphibious; it can negotiate a ford up to 1 m deep.

Production of the 4K 7FA, an improved version of the APC, has been arranged at the present time. It already has entered the inventory of the Austrian Army, has been purchased by Bolivia and Nigeria, and is being produced in Greece under license. In contrast to the base model, the 4K 7FA is equipped with passive night vision devices and its engine and transmission have been improved. A command and staff vehicle, medical vehicle, 81-mm self-propelled mortar, and self-propelled antiaircraft mount armed with two 20-mm twin automatic guns were created on the base of this APC. There also are plans to install single-place armored turrets with 20-mm, 25-mm or 30-mm automatic guns on the APC. A variant of a fire support vehicle armed with a 90-mm gun mounted in a two-place turret has been developed.

In 1979 Steyr-Daimler-Puch began developing the Pandur wheeled (6x6) APC (Fig. 3 [figure not reproduced]). Production began in 1986.

The APC hull is welded from steel armor plates. The engine-transmission compartment is in its right front section and the driving compartment is on the left. The commander is accommodated behind the driver. The assault compartment is accessed through armored doors in the rear of the vehicle.

The base version of the Pandur APC is armed with a 12.7-mm machinegun. A prototype also has been created with a two-place armored turret in which an Oerlikon 25-mm automatic gun has been mounted.

A six-cylinder diesel engine connected with an Allison automatic transmission is used as the power plant on the APC. The vehicle has spring suspension with hydraulic shock absorbers. There is a centralized tire inflation system. The foreign press notes that this APC has high road speed (maximum 105 km/hr) and a large range (up to 650 km).

It is planned to create a family of armored vehicles for various purposes on the basis of the Pandur APC: reconnaissance, medical, twin 20-mm self-propelled antiaircraft mount, 81-mm self-propelled mortar, as well as a fire support vehicle armed with a 90-mm gun.



Specifications and Performance Characteristics of Austrian Armored Equipment Models

Model Name or Designation	Combat Weight, tons	Dimensions, m: Height	Weapon Caliber, mm	Engine Output, hp	Maximum Speed, km/hr
	Crew (Mounted)	Length x Width	Cun Machineguns		Range, km
SK-105 Kürassier light tank	17.5 3	2.53 5.58 x 2.5	105 7.62	320	65 520
4K 4FA tracked APC	12.5 2(8)	1.65 5.4 x 2.5	— 12.7	250	65 370
4K 7FA tracked APC	14.8 2(8)	1.6 5.67 x 2.5	— 12.7	320	64 520
Pandur wheeled APC	11 2(8)	1.8 5.69 x 2.5	— 12.7	210	105 650
ÖAF combat reconnaissance vehicle	17 5	— 5.8 x 2.5	35 7.62	320	103 —
1990's tracked combat vehicle	18.8 3(8)	2.5 6.14 x 2.65	30 7.62	450	70 500

The firm of Österreichische Automobilfabrik (formed in 1977) created the OAF wheeled (6x6) combat reconnaissance vehicle, which still is in the prototype stage. According to foreign press data, this combat reconnaissance vehicle (Fig. 4 [figure not reproduced]) has high speed and good trafficability on rugged terrain, and is armed with an Oerlikon 35-mm automatic gun. A 7.62-mm machinegun is coaxial with the gun, mounted in a two-place armored turret. As in previous models, the vehicle hull is welded from steel armor plates with reinforcement of the frontal armor. It was planned to outfit the combat reconnaissance vehicle with modern equipment needed for conducting reconnaissance. It is planned to use the vehicle's wheeled chassis for creating light armored vehicles for various purposes, and in the 8x8 wheeled version as the base for a 155-mm self-propelled howitzer.

Specifications and performance characteristics of Austrian armored equipment models are given in the table.

With respect to future developments, western specialists single out work presently being done by Steyr-Daimler-Puch to create a tracked combat vehicle of the 1990's chiefly in the infantry fighting vehicle version. It is presumed that this will be a highly mobile, well protected vehicle armed with a 30-mm automatic gun.

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#### The Fighter Combat Mission and Artificial Intelligence

18010378i Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 12, Dec 1988 (signed to press 7 Dec 88) pp 37-42

[Article by Col Yu. Kartenichev, candidate of military sciences, and Maj A. Petrov, candidate of military sciences]

[Text] Military experts of the United States and other NATO countries believe that when flying in modern, sophisticated aviation equipment the pilot or crew as a

rule functions at the limit of intellectual capacities. In order to employ on-board weapons effectively, the pilot or crew must correctly and promptly receive and analyze enormous volumes of data coming from on-board and ground equipment. With present technical outfitting a pilot has to deal partly not with the processes of airborne target acquisition, intercept and engagement proper, but only with their analogs represented on special displays in the form of alphanumeric and other data collected, processed and stored by automated systems. The more complete this data, the more precise is a pilot's impression of the combat process and the more efficient a decision he can make.

American military experts substantiated the problem of improving information support to air combat operations based on this. The creation of special automated data collection, processing and distribution systems became one of the ways of solving it. For example, the JTIDS—Joint Tactical Information Distribution System—was developed in the early 1980's. An improved version, the EJS (Enhanced JTID System), presently is being created for the U.S. Air Force and is to be introduced in the early 1990's.

Another direction in solving this problem was the development and creation of on-board integrated flight and weapon control systems permitting fuller use of the potential capabilities of aircraft. For example, flight testing is already under way on experimental models of systems representing a realization of two different concepts for creating integrated automated flight and weapon control systems: the Firefly analog system intended for the F-15 Eagle fighter, and a digital system with which a specially refitted AFTI/F-16 aircraft is equipped. Foreign military specialists assert that fighters with such systems aboard will gain substantial tactical advantages over those which do not have such equipment. In particular, accuracy of conducting fire in operations both against airborne and ground targets will be considerably improved.

The Firefly automated flight and weapon control analog system is being developed by McDonnell Douglas and General Dynamics. In air-to-air combat it allows taking the aircraft into the weapon employment zone (based on data on position and angular velocities of the target, distance to target and closing rate). In the assessment of American experts, the probability of hitting a target is trebled in firing a cannon using this system.

The integrated digital automated flight and weapon control system is being developed by General Dynamics within the scope of the AFTI/F-16 research program. Firm specialists believe that it has greater capabilities than the Firefly and can become the basis in creating an automated flight and weapon control system for fighters of the 1990's.

In the views of western experts, however, it is clearly not enough to provide information support alone to the activity of tactical fighter crews and equip them with automated flight and weapon control systems. In their opinion, it is necessary to create special automated equipment including elements of artificial intelligence to facilitate the process of working out, making and executing a decision by the pilot or crew on a combat mission. This requirement is substantiated as follows.

The pilot or crew must make instantaneous decisions in a complicated tactical situation while executing a mission of engaging a particular target. Timeliness and correctness in producing the decisions substantially affect the result of mission execution.

The information flow which the pilot must receive and evaluate before making a decision grows continuously with the development of aircraft equipment and air-to-air combat tactics. American specialists believe that in the future a combat mission will be so complicated that without outside help a pilot will be unable to promptly cope with the enormous quantity of information data and use it properly for making the optimum decision. The journal AIR FORCE MAGAZINE emphasizes that for this it is necessary to have a special information display that would assist the pilot in maneuvering, identifying targets, selecting and employing weapons, and monitoring the aircraft's attitude in space. At the same time it notes the possibility of creating on-board devices built on the basis of high-speed computers with a large storage capacity and appropriate software which would help make the most efficient decisions on a combat mission on a timely basis.

In the opinion of American specialists, fighter controls and their armament combine well with automated flight and weapon control systems, which permits using them together with special on-board equipment intended for assisting in the crew's decisionmaking in the principal phases of a combat mission under various situational conditions without particular difficulty. The press often calls such equipment a decisionmaking device. It is

noted that this subject matter presently is being worked on by practically all U.S. aircraft construction corporations, including Lockheed (Fig. 1 [figure not reproduced]).

The methodology of an approach to problems of creating a decisionmaking device for the fighter by which some American aircraft experts were guided in the initial stage of development are examined below based on data published in the foreign press.

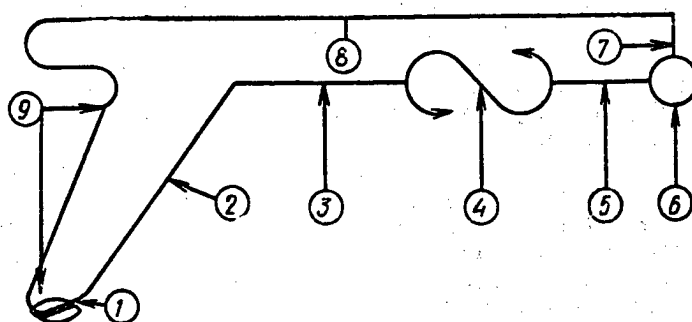
American specialists above all proceeded from the assumption that a fighter combat mission is made up of the following relatively independent stages: takeoff, climb, flight to the zone, zone alert (patrolling), flight to intercept a target, air-to-air combat, disengagement, return to airfield, and landing (Fig. 2). The primary stages in which the pilot or crew especially needs intellectual support are considered to be zone alert (patrolling), target intercept, and air-to-air combat. For example, while patrolling, the fighter pilot observes a display of the tactical situation on the screen and must independently make the decision to intercept a particular target (if there is no instruction from the command post for this) or continue combat air patrol. The decision depends on results of target identification and the situation estimate. The modern fighter's equipment permits the pilot to identify the target, but at the same time he does not have information on the displays about the possibility of a successful intercept. Therefore the situation estimate and decisionmaking are based for now on a person's knowledge, experience and intuition.

If a decision to intercept has been made, the pilot selects mission profile and power conditions and determines all other details of mission execution including the maneuver for launching an attack at an aspect guaranteeing successful missile launch (or cannon fire), i.e., he must make a number (a chain) of successive decisions having the end result of engaging and destroying the hostile aircraft. The processes of producing these decisions are rather complex and so a decisionmaking device can be used to assist the crew in such a complex flight phase.

When the first models of decisionmaking devices were developed in the United States, hierarchic models were used which considered subtasks as component parts of the main combat mission as well as models of the choice of the method of executing it based on rules of airborne target intercept. The on-board computer has to model the maneuver execution sequence, output recommendations for execution, and select and display on the screen the optimum method of operations.

The most effective plan for accomplishing a combat mission can be produced if the results of each option in a specific tactical situation are examined. Inasmuch as the crew has extremely little time to evaluate different options when conducting air-to-air combat, the results of a preliminary off-line computer analysis using expert systems<sup>1</sup> must be input.

Fig. 2. Principal stages of a fighter combat mission



Key:

1. Take-off
2. Climb
3. Flight to zone
4. Zone alert (patrolling)
5. Flight to intercept target
6. Air-to-air combat (attack)
7. Disengagement
8. Return to airfield
9. Landing

In the opinion of American experts, the result of a fighter combat air patrol is formed from accomplishing three key tasks: assuring maximum safety of the protected object ( $w_1$ ), attaining maximum tactical success ( $w_2$ ), and expending minimum resources such as fuel ( $w_3$ ). Each has a large number of characteristics and represents a set of specific subtasks which either are measurable characteristics in themselves or are endowed with them. An evaluation of the combination of characteristics provides indications for fulfillment of key tasks, and an evaluation of the combination of degrees of attainability of these tasks provides a determination of the possibility of successfully executing the combat mission as a whole. The logical sequence of mission accomplishment (success hierarchy) is shown in Fig. 3.

Judging from western press materials, the first key task can be broken down into two basic subtasks: covering the maximum number of targets and reducing the depth of penetration of enemy aircraft to a minimum. Coverage is taken to mean the ratio of targets being attacked by the fighters to the overall number of aircraft taking part in the penetration. Penetration depth is determined by the calculated distance (range) from the center of the defended object to the nearest penetrating target, or to a priority target being attacked, or to the middle of the combat formation of enemy aircraft (group of targets).

The second key task is to attain maximum tactical success, i.e., increase the presumed kill probability of a group of targets ( $E_y$ ). This is determined by solving three basic subtasks: maximum number of enemy aircraft engaged, time targets are illuminated by on-board radar or a guided missile homing head, and distance between

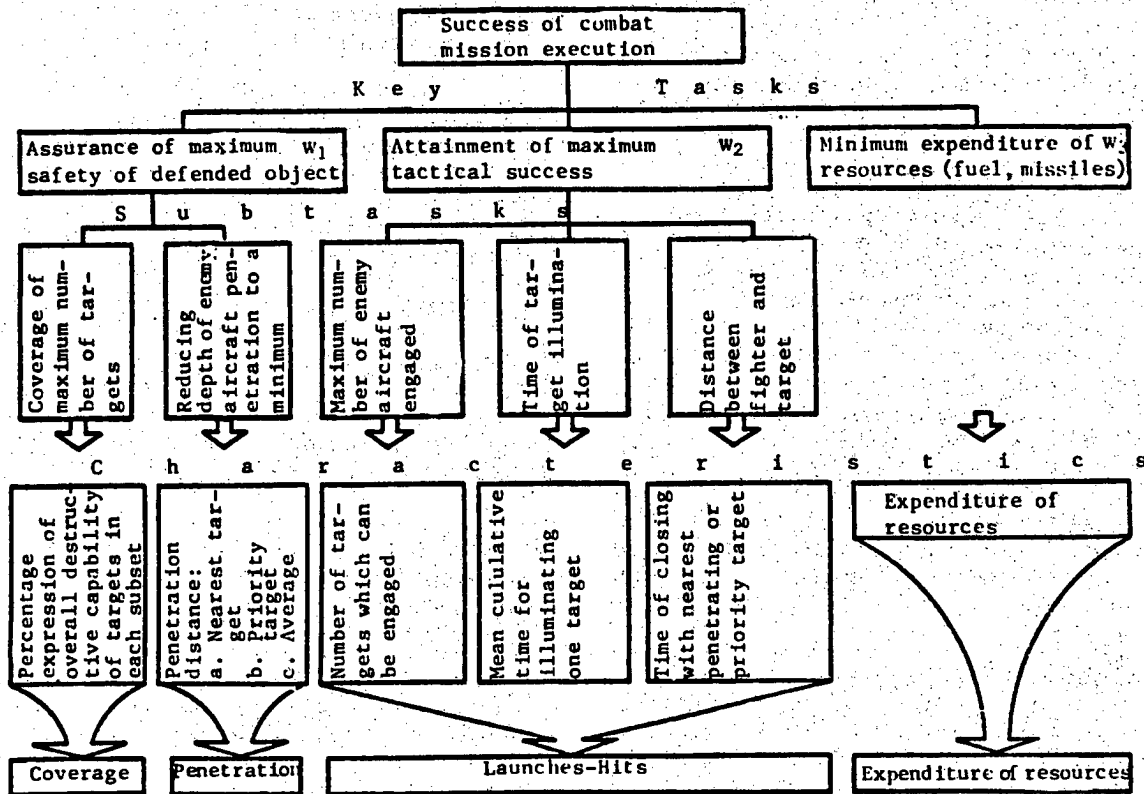
the fighter and target. The latter factor determines the time it takes the fighter (or its missile) to close with the nearest or priority penetrating enemy aircraft.

The third key task is minimum expenditure of resources. Its predetermined characteristic is the fuel remainder after execution of each maneuver and the ammunition (missile, projectile) remainder on disengaging.

The degree of importance of characteristics determining success of combat mission execution changes depending on the tactical situation. For example, American military specialists singled out six possible options (methods) for executing a combat mission:

1. Offense—maximum increase in the number of downed enemy aircraft, with a secondary objective being a maximum increase in safety of the defended object as well as conservation of fuel and ammunition stores ( $w_2 > w_1$ ,  $w_2 > w_3$ ).
2. Defense—maximum assurance of the object's safety, with a secondary objective of achieving maximum tactical success and conserving fuel and ammunition stores ( $w_1 > w_2$ ,  $w_1 > w_3$ ).
3. Conservation and offense—maximum increase in  $E_y$ , conservation of fuel and ammunition stores, actually ignoring the object's safety ( $w_2 > w_1$ ,  $w_3 > w_1$ ).
4. Conservation and defense—maximum assurance of the object's safety, conservation of fuel and ammunition stores, actually ignoring  $E_y$  ( $w_1 > w_2$ ,  $w_3 > w_2$ ).

Fig. 3. Logical sequence of successful combat mission execution (success hierarchy)



5. Safety of the defended object—only maximum assurance of its safety ( $w_1=1$ ,  $w_2=w_3=0$ ).

6. Maximum destruction—maximum increase in presumed kill probability of enemy aircraft  $E_y$  and that alone ( $w_2=1$ ,  $w_1=w_3=0$ ).

Each of these options has its own group of characteristics differing from each other in importance. The first four are "compromises" and differ in a varying combination of characteristics. The last two are "pure," where preference is given to accomplishing one task, either assuring maximum safety of the object or attaining the greatest kill probability of a group of targets.

All six options correspond to a different tactical situation. They are classified depending on conditions connected with the following variables: range of penetration—distance of target from the center of the defended object or from the enemy's line of employment of air-to-surface weapons; fuel (ammunition) remainder and quantitative advantage—number of missiles on the fighter in comparison with the number of targets; kill capability—ratio of the number of missiles launched to targets downed. The exhaustive number of relationships between mission accomplishment options and conditions determining the criterion of transition from one to another is described by complex mathematical relationships.

In a combat situation the decisionmaking device carries out an automatic transition from one option to another as the "perceived" information changes. At the same time, a pilot can do this manually, i.e., independently and regardless of the decisionmaking device's decision.

The process of interaction between the crew and decisionmaking device in the course of executing a combat mission begins after the acquisition and identification of targets. Information received with the help of on-board and ground equipment is shown on the display as a totality of data changing over time and characterizing the existing tactical situation. The decisionmaking device suggests the option suitable for accomplishing the assigned mission, evaluates the degree of necessity to execute a maneuver to take up a favorable position and, if necessary, outputs recommendations on the procedure for executing it.

The crew does not have to follow the decisionmaking device's recommendations but can make and execute its own decision, especially if a priority target has been detected.

A special situation takes shape when more targets than the computer can process appear on the data display system screen from the very beginning. The computer places the most important ones into subsets, which then are processed by the decisionmaking device.

Recommendations on selecting a subset of targets for attack are displayed on the screen. Proposals for selecting a certain subset and for the corresponding maneuver are initiated by the inscription: "Subset Recommendation" and by movement of the control command symbol on the tactical situation screen.

Considering the chief purpose of the decisionmaking device (relieving the crew of intellectual load and transferring it to an on-board automated system), western experts believe that device controls have to be an elementary combination of a minimum number of buttons. In particular, there were only six main buttons on the control panel of one of the first models of a decision-making device being developed in the United States for the F-14 fighter, corresponding to six mission execution methods (options); using the buttons, the pilot or operator could manually select one of the options. If he did not do this the option for actions was selected by the computer automatically according to a previously loaded program.

There are two buttons on the target selection panel: One is "Priority" and the other is "Manual Subset Select." After pressing the first button a pilot can keep the target on the tactical situation screen. It stands out among all other targets intended for subsequent evaluation. Pressing the second button permits outputting the entire subset to the screen. The pilot informs the system about completion of subset selection by pressing the same button again.

The "Reset" button permits resetting a portion of the decisionmaking device logic for automatic transition from one mission execution option to another. As soon as this part of the software is activated, recommendations for selecting a subset of targets corresponding to the given option are automatically put out by the decision-making device to the tactical situation screen together with necessary heading changes, indicated by displacements of the control command symbol. The pilot can use this button in three cases: when he has decided to change the manually selected mission execution method; if after pressing the "Priority" button he does not pick this target out or changes his decision after picking out a more important target; and if he doubts the correctness of manual selection of a target subset or decides that one or more of them have been selected incorrectly.

The "Override" button permits clearing the recommended heading maneuvers in connection with an attack of a selected target subset.

When the recommendation on executing a maneuver is put out, the control command symbol moves on the tactical situation screen and the recommended aspect appears on the screen with the inscription ASPECT MAN ("Aspect Maneuver"). In pressing the "Override" button (after a maneuver execution recommendation is

put out), the symbol returns to the previous place, the inscription disappears, and the decisionmaking device program immediately begins supporting target subset selection.

During output of a recommendation on target subset selection, this subset is highlighted on the screen, the symbol moves across the tactical situation screen and the inscription TAR ACQ MAN ("Target Acquisition Maneuver") appears. If the "Override" button is pressed at the time a target subset recommendation is output, the closest target subset is displayed on the screen with output of corresponding maneuver data.

If the pilot or operator believes that the recommendation produced by the decisionmaking device is unsatisfactory, he can manually select targets by "holding" them on the tactical situation screen after pressing the "Manual Subset Select" button.

The foreign press reports that in the future the decision-making device can be used to give a fighter crew substantial help during execution of a combat mission without changing its usual operating procedure. It is noted that results of theoretical research obtained in the United States and other NATO countries have shown that even at the present level it is possible to create effective automated systems of so-called pilot or crew intelligent support to their combat mission execution.

#### Footnotes

1. For more details on expert systems see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 5, 1988, pp 13-16—Ed.

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#### Aircraft Simulators: Status and Development Prospects

18010378j Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 12, Dec 1988 (signed to press 7 Dec 88) pp 42-47

[Article by Col Yu. Alekseyev, candidate of technical sciences]

[Text] While giving the principal role in improving flight crew training to practicing missions in aircraft, foreign military specialists nevertheless take note of the ever-growing importance and potential capabilities of using practice in aircraft simulators in this complicated and costly process. Tactical aircraft simulators are the most widespread in air forces of leading capitalist countries. The overwhelming majority of them are specialized, i.e., they make it possible to practice one kind of combat mission: conducting air-to-air combat or delivering strikes against ground targets. Simulators of both types are essentially identical in design. As a rule, they consist of a spherical dome 7-12 m in diameter on a dynamic

suspension system with several (up to six) degrees of freedom, with the pilot's cockpit (an analog of a combat aircraft cockpit) in the center. The situation is displayed on the inner surface of the sphere using special projectors. There also are flat-screen simulators.

*Air-to-air combat simulators.* The dome arrangement is regarded as preferable for them compared with a flat screen, since it permits simulating the air situation with great realism (Fig. 1 [figure not reproduced]). The simplest air-to-air combat simulators are single-cockpit or single-section (single-dome) simulators in which the pilot is trained under the "pilot-computer" arrangement (according to a fixed program) or "pilot-instructor" arrangement (the instructor can control one or more airborne targets). In addition to an air situation display, air-to-air combat simulators have a simplified ground situation display for the pilot's general orientation (particularly for estimating flight altitude above the terrain). Aircraft movement dynamics are simulated by mechanical displacement of the cockpit and a system of inflatable chair chambers acting directly on the pilot's body.

The Mirage-2000 fighter simulator which the French Air Force has at Dijon Air Base can serve as an example of a simple single-section air-to-air combat simulator. It allows displaying two airborne targets and a simplified display of the ground situation on the return to the air base. Foreign specialists assume that single-section simulators as a whole make it possible to teach single air-to-air combat, but two-section and three-section simulators are needed for training in group combat (one pilot against two or three targets respectively). In particular, the French MARS (Multiple Action Raid Simulation) three-section air-to-air combat simulator at Mont-de-Marsan Air Base is used by Mirage-F.1 and Mirage-2000 fighter pilots (Fig. 2 [figure not reproduced]).

Multisection air-to-air combat simulators are very expensive, and so a number of western countries use them primarily for research purposes. For example, the FRG Ministry of Defense has two-section simulators (dome diameter 12 m, electronics include digital and analog computers) at the research center in the city of Ottobrunn, which simulate both the F-104, F-104F and Tornado fighters in the West German Air Force inventory as well as the principal types of enemy aircraft. In Great Britain the firm of British Aerospace has a simulator of the future EFA fighter being developed by a number of European NATO countries. Its domes 9.1 m in diameter are made of three-ply fabric and have a pressurization of 0.005 kg/cm<sup>2</sup>. Dimensions of inner surfaces of the spheres (situation display screens) are maintained with an accuracy to 15 mm.

*Simulators for practicing missions of delivering strikes against ground targets* are similar in functional design to civil aviation simulators, and in design execution to single-section air-to-air combat simulators. They are intended for practicing a complete combat mission (from takeoff to landing). The surrounding situation is

displayed with the help of a computer, and the instructor is capable of inputting essentially any number of malfunctions and simulating special instances which may be encountered in flight. It is assumed that the primary difficulty in creating such simulators is development of a system for visual display of the surrounding situation, and particularly simulation of the aircraft's on-board equipment.

*Multifunction (integrated) simulators.* A discussion over what the aircraft simulator should be like has been carried on abroad for a long time now. Many air force experts of leading NATO countries favor multifunction simulators, individual models of which already have been created at the present time. Existing air-to-air combat simulators were taken as their basis, but with broader capabilities for teaching execution of a mission of delivering strikes against ground targets.

One such simulator was developed by the French firm of Thomson-CSF for the Mirage-2000 fighter based on a two-section air-to-air combat simulator. In it a synthesized ground situation is displayed in a 40° horizontal and 30° vertical sector. A simplified ground situation display is given for transition flight configurations, and a rather detailed one is given when practicing navigation problems. Appropriate objects (bridges, runways, other facilities, Fig. 3 [figure not reproduced]) are displayed when accomplishing missions employing on-board weapons against ground targets. The task of coming in for a landing is practiced with a display of the ground situation in a 60x60 km zone.

The Harrier-GR.5 fighter multifunction flight simulator of the British firm of Singer-Link-Miles is single-section with a dome 7.3 m in diameter on a dynamic suspension system with six degrees of freedom. It provides for displaying both the general situation within limits of 240° in the vertical and 130° in the horizontal, as well as a detailed situation with high resolution in an 18° sector relative to the pilot's line of sight. The displayed ground situation permits practicing missions in low altitude flight and searching for targets; for an attack on ground targets data are output about "friendly" targets (for example, tanks) on the battlefield. The operation of all an aircraft's electronic equipment can be simulated in the process of pilot training. In "ejecting," a computer outputs a "success" signal to the pilot. Operation of the simulator is controlled by two instructors from a remote cockpit.

The WST (Weapon System Trainer, Fig. 4 [figure not reproduced]) of the American B-52 strategic bomber is a typical example of a comprehensive accomplishment of tasks and training of flight crews. It enables the training of two pilots, two offensive weapon operators and two defensive weapon operators at the same time; 80 percent of the simulator's machine time is used for training the aircraft crew as a whole, and 20 percent for separate training sessions of pilots and operators (in pairs).

The F-15E fighter trainer uses a multichannel system for displaying a synthesized air and ground situation; its operation is supported by digital charts and cartoons. This simulator makes it possible to train in working with the LANTIRN, the latest targeting-navigation system. Two simulators were to become operational in 1988 at Luke Air Base, Arizona, timed for activation of the first wing of F-15E fighters (see color insert [color insert not reproduced]).

The foreign press analyzes the capabilities of the modern multifunction helicopter simulator in the example of the American AH-64A Apache helicopter simulator (several years ago the advisability of creating such a simulator was doubted abroad). It consists of two separate pilot and gunner cockpits. A digital image generator provides a display of data on the general surrounding situation and, separately, data from a forward-looking infrared device and from television and optical equipment. Up to ten threat scenarios (enemy weapons) are simulated, and instructors can input a degree of threat on a ten-point scale. Targets are displayed for trainees at distances up to 8 km, and for instructors up to 10 km (targets which potentially can fire on the helicopter are highlighted at the instructor panels). It is assumed that the simulator permits practicing flight at extremely low altitudes at a speed up to 110 km/hr and employment of the helicopter's main armament: Hellfire ATGM with laser guidance system, 70-mm free-flight rocket and 30-mm gun. The calculated simulator operating intensity is 15-18 hr/day and technical readiness is up to 90 percent. In the future it is planned to supplement the flight simulator with specialized weapon and EW system simulators.

Primary emphasis in military transport aircraft simulators is placed on simulating operation of electronic equipment, which carries the principal load in supporting flights. For example, the American C-5B Galaxy simulator uses a situation display system and computer which simulate flight conditions, including emergencies, in real time. The calculated intensity of simulator operation is 20 hr/day and technical readiness is up to 99 percent. A system of simulators for the C-130 Hercules is being developed based on a flight simulator (Fig. 5 [figure not reproduced]). In addition, it is proposed to create a simulator for preliminary training in working with aircraft on-board systems based on the use of multiplex equipment. It is planned to set up such simulator systems in flight crew training centers.

There also are simulators for training crews of special-purpose aircraft. In particular, the U.S. Air Force has a C-12F aircraft simulator in which communication aircraft crews are trained. In addition to flight simulators, more and more attention is being given to simulators for training ground technical personnel. The following simulators have been created in recent years: maintenance simulator, a specialized simulator for servicing electronic equipment and armament of the B-1B bomber, and a simulator for servicing and maintaining AWACS early warning and control system aircraft.

*Situation display equipment.* The simplest consists of projectors; the overall situation is created by superposition of images from separate projectors. As a rule, three projectors are used: for the horizon, for an airborne target (enemy aircraft, attacking missile, and so on), and for the ground situation. The American F-15 fighter simulator is equipped with a situation display system executed on the basis of a cathode ray tube. It provides an image of airfields, dynamic targets, topographic terrain features, populated points, and the tactical situation (transparency of the atmosphere, launch of guided missiles, destruction of target). The situation is displayed within limits of 160° horizontally and 60° vertically, which subsequently are proposed to be expanded to 240° and 130° respectively. The computer provides the image of an area of 400,000 km<sup>2</sup> and a flight corridor of 160x35 km for practicing navigation skills, and an area of around 500x500 km is displayed for training in flights at low altitude and high speed.

*Prospects for development of aircraft simulators.* The opinion of western specialists on possible paths for aircraft simulator development shapes up in favor of multifunctional models. There is also a material basis for this—the rapid development of electronics and computer technology. All this does not mean, however, that specialized simulators will disappear. Judging from foreign press announcements, another trend also is beginning to show—creation of a system of simulators which can include a multifunctional simulator (system basis) and several specialized ones. It is assumed that this approach will provide more effective training on the basic simulator after a preliminary training course on specialized simulators. In addition, the latter are best used for practicing special missions. At the same time it is noted that despite the rapid development of simulators, the amount of flight training must be no less than a specific annual minimum such as 180 hr.

It is proposed to ensure the multifunctionality of simulators meeting present-day and future demands chiefly on the basis of image synthesis, an increase in the number of colored objects displayed with texture (picture elements), and wide use of digital image processing equipment. Image texture is taken to mean giving different shades and pattern to individual picture elements (as a rule these are polygons of small size, a kind of mosaic from which the overall situation picture forms) or individual objects. It is believed that this provides great reality of the displayed situation, especially the ground situation, and permits getting by with fewer individual picture elements (i.e., demands on simulator electronic gear can be reduced).

The use of digital engineering (particularly conversion of photographs into digital charts) makes it possible to realize the complex image textures and a high degree of their detailing with an updating rate of 30-60 per second. It is also possible to display such atmospheric phenomena as fog, isolated clouds and others.



Initially the regeneration of image texture was based on the principle of mathematical modeling, but this method did not provide full reality of the displayed situation. The task was resolved only on the basis of extensive use of digital equipment. Digital systems permit using data coming to the pilot from other systems and accomplish what previously was impossible, such as a calculation of distance to a target being illuminated by a laser or the simulation of flight altitude above the terrain.

But large storage and large capability of computer processors are necessary for detailed display of the situation over considerable areas (spherical domes on whose inner surface the situation is displayed reach 12 m in diameter). Modern technology does not yet permit accomplishing this task as applied to simulators, and so simulator developers are taking the path of a detailed display of those sectors of space which interest the pilot.

The first systems of this type used helmet displays with wide and narrow fields of vision. It is reported in particular that such a helmet display was created in 1985 by the Canadian firm of CAE based on fiber optics. The display's instantaneous field of view is 135° horizontally and 64° vertically with an overall 360° field of view. A quality image is provided within limits of the entire field of view, but image resolution is substantially higher in the central binocular sector (19x25° or 30x55°), i.e., in the sector of the relative optical axis of the pilot's eyes. The display is sufficiently transparent that it practically does not degrade the view of aircraft cockpit instrumentation. The helmet with display and corresponding gear weighs around 4 kg.

Developers of situation display systems with higher resolution in a narrow field of view immediately encountered the problem of how to determine where the pilot is looking. It is believed that it is possible to use the orientation of the pilot's head for a rough estimate of this direction, but what was to be done during g-loads? Specialists of the Canadian firm of CAE assume that a servo system must be developed which reflects the position of the eye's optical axis. The British firm of Readyfusion is conducting developments in that same direction together with some American firms. The display prototype it created (Fig. 6 [figure not reproduced]) already has been tested on the T-2C trainer aircraft simulator. The display's instantaneous field of view is 140x100° and the detailed view sector is 27x24°. The pilot's head movements are tracked by a helmet sensor, and a small television camera focused on one of the eyes works out eye movement every 16 milliseconds. Data from tracking equipment go to the image generator. The helmet and gear weigh around 2.7 kg. Similar helmet systems for displaying the surrounding situation are being developed in France and Israel.

Israeli specialists see the future in use of holographic display equipment, which in their opinion will allow reducing the number of helmet optical devices and accordingly reducing helmet weight. Israel already is

developing an experimental flight helmet with a holographic situation display (a round holographic element is built into a common helmet shield, and in the series model of the helmet the entire shield will support holographic imagery). The helmet system's overall field of view is 30x26° and the system tracking pilot head movements uses a helmet television camera with a tracking accuracy of 2 millirads (0.1°). The helmet weighs around 1 kg. It is proposed to test it in combat aircraft (F-15 and F-16) and use it both in simulators and in Air Force line units.

Development of displays with a wide and narrow (high resolution) field of view is considered one of the key factors in creating future simulators. Another no less important factor is creation of equipment for synthesizing and storing data on the surrounding situation. Its importance lies in the fact that future multifunctional simulators must support simulation of a wide range of conditions, from maneuverable air-to-air combat to extremely low altitude flight, from a flight as part of groups to delivery of strikes against ground targets.

The VDS 1000 video system of the American firm of Ivex is considered one of the promising situation display systems. It displays a sector of terrain some 1,300 km<sup>2</sup> in a 48x36° field of view with high resolution on the basis of digital gear. Information necessary for the system's operation is stored basically on video disks read by a laser. The gear also includes an image generator and central processor. A feature of this system is that only that information not requiring real-time display is stored on the video disks, while other data are stored in the computer. A special compaction system is used allowing the recording of up to 15 gigabytes of data on one disk. Data on image texture are stored on digital photographs with random access; data on targets and three-dimensional objects are stored on separate disks. Video data read from the disks are converted to digital data.

The VDS 1000 video system was created to train pilots of single-engine aircraft and already has been proposed for the Tucano trainer simulator. One of its versions allows the display of 300 picture elements, and another allows the display of 1,000 picture elements.

Further development of situation display systems in simulators is contemplated in the creation of panoramic systems with horizontal sectors of view of 150-160° or more. It is reported that such a system already is being used in the KC-10A transport/tanker simulator, and that an experimental panoramic system with a 200° sector of view already has been created. As another typical trend in the development of aircraft simulators, their use of a system of distributed computers with corresponding microprocessors with a capability of 0.4-10 million operations per second is being considered.

At the present time it is very difficult to delimit military and civilian use of computers, microprocessors and other aircraft simulator gear. Considering this circumstance, western simulator developers are trying to



involve the S&T potential of many civilian sectors of the economy in this work more and more widely, thus creating an additional opportunity for its militarization.

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**British Royal Air Force Exercise Elder Forest-88**  
18010378k Moscow ZARUBEZHNOYE VOYENNOYE  
OBOZRENIYE in Russian No 12, Dec 1988 (signed to  
press 7 Dec 88) pp 50-51

[Article by Lt Col M. Shamshurin]

[Text] In April 1988 the annual opposed-forces British Royal Air Force exercise codenamed Elder Forest-88 was held over the territory of the British Isles. The exercise was directed by Chief Air Marshal R. Harding, CIC of the Royal Air Force.

Subunits of the Royal Air Force (Tornado, Phantom, Lightning and Hawk aircraft) and U.S. Air Force (F-5E's stationed on British territory and F-16's moved to the British Isles to conduct Exercise Elder Forest-88, as well as early warning and control aircraft and tankers) took part in it on the Blue side. Also brought in were subunits of Bloodhound and Rapier surface-to-air missiles and AAA subunits armed with 35-mm Oerlikon guns captured from Argentina during the Anglo-Argentine conflict over the Falkland (Malvinas) Islands.

Operating on the Orange side were tactical aircraft of ten NATO member countries, which delivered strikes against targets on British territory and against ships in the North Sea from bases located in Northern and Central Europe.

Judging from foreign press announcements, the primary objective of the exercise was a comprehensive check and rehearsal of plans for organizing and conducting an air offensive operation, including an evaluation of the capabilities of personnel and resources of the Atlantic air defense zone to repel mass air strikes. The Blue force by tradition played the role of the defending side and the Orange force played the role of aggressor.

The beginning of the exercise was preceded by a preparatory period during which, according to the concept of exercise organizers, there was a sharp aggravation of the international situation leading to the appearance of an armed conflict.

The exercise lasted four days. On the first day the Orange force stepped up aerial reconnaissance and provocative actions in the air with the objective of uncovering the Blue air defense system and armed forces grouping. Then the Orange force began delivering air strikes against airfields and air defense installations located in the British Isles as well as against Blue ships in the North Sea. Special ranges situated on the east coast of England

and Scotland were used extensively during the rehearsal of combat missions. An overall total of more than 1,000 low and medium altitude sorties were flown.

The Blue force carried out the preparation and execution of measures to repel the air strikes. They used E-3A and Shackleton early warning and control aircraft to increase the range for detecting "enemy" aircraft. Fighter-interceptor radius of action was increased by aerial refueling by Tristar, Victor and VC-10 tanker aircraft.

Training missions were practiced under conditions of the enemy "employment" of chemical weapons.

According to foreign press announcements, Exercise Elder Forest-88 was the largest held by the Royal Air Force since World War II. Its great importance is attested in particular by the visit of U.S. Gen J. Galvin, Supreme Allied Commander Europe.

In the NATO command's assessment, exercise results demonstrated the increased combat capabilities of the air defense system of Great Britain, the territory of which is of vital importance for logistic support of the grouping of bloc forces in Europe in case of war. It is believed that this was achieved to a considerable extent because of the arrival of new Tornado fighter-interceptors in the Royal Air Force inventory in place of obsolete aircraft, and because of the pilots' increased level of combat training.

Along with a high evaluation of exercise results, it is noted that the exercise did not get by without a number of accidents, the most serious of which was the crash of a British Phantom aircraft and the loss of both crew members.

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**FRG Air Force Aviation Medicine Institute**  
18010378l Moscow ZARUBEZHNOYE VOYENNOYE  
OBOZRENIYE in Russian No 12, Dec 1988 (signed to  
press 7 Dec 88) pp 51-52

[Article by Lt Col Ye. Melnikov]

[Text] The swift development of aviation, increased complexity of flying craft, and increase in g-loads and flight speeds in recent decades generated a sharp increase in physical and mental loads on military pilots and made the demands being placed on their health more exacting. This is what dictated the creation of specialized military science establishments in leading capitalist countries engaged in medical-biological research and applied problems connected with selecting, conditioning and training flight personnel; maintaining the health and working capacities of crews at the proper level; and preventing air mishaps.

In the Bundeswehr these functions are assigned to the FRG Air Force Aviation Medicine Institute in the city of Fürstenfeldbruck. Organizationally the Institute consists of six departments, each of which handles specific problems and has special equipment for this purpose:

- The first resolves medical problems proper;
- The second tests and conditions candidates for flight operations under near-real conditions;
- The third studies the effect of g-loads on crews in flight;
- The fourth researches problems of optimizing the work stations of flight personnel, including cockpit equipment, with the objective of making a maximum improvement in convenience and flight safety;
- The fifth department is assigned to study the effect of various factors on the pilot's body in flight and analyze statistics of air mishaps;
- The sixth handles psychophysiological aspects of flight activities.

A check of the fitness of future pilots begins with psychological tests conducted in the sixth department using a special simulator. Candidates have to fly an "aircraft" in accordance with given flight parameters while a computer simulates a constant deviation from them. In addition, the candidates are asked to solve simple arithmetic and logic problems to evaluate their capability to perform several kinds of work simultaneously. Psychological and personality traits necessary in flight operations are identified and evaluated in the course of a talk with a psychologist and during special testing. Preference is given not so much to a candidate's high level of mental development and intelligence as to a practical turn of mind, reaction speed, mental stability, endurance and, finally, perseverance. In the opinion of Institute specialists, these are the qualities needed by a future pilot. Each year approximately 79 percent of candidates successfully pass the psychophysiological check.

Then the subjects are sent to the second department for medical examination for fitness for flight operations. No small significance is attached to the candidates' anthropometric characteristics: height can be within the limits of 162-193 cm, weight from 59 to 96 kg, and length of femur must not exceed 68 cm; otherwise difficulties might arise in abandoning the aircraft in case of emergency. This same department conducts special training of flight personnel, including weeklong basic and refresher courses. Classes are structured in accordance with curricula of the military educational institutions in which the selected candidates will train.

In addition, so-called courses for jet aircraft passengers are organized in the second department. All Bundeswehr servicemen who use military jet aircraft because of the nature of official duties must take them.

Ejection is one of the important subjects of any of those courses. Students study ejection seats (four types) being used in the Bundeswehr, and practical classes are held with them on an ejection device simulator. The future pilots are "ejected" an overall total of four times in the course of training, and two volunteers from each training group of "passengers" make an ejection. Each year some 800 persons practice ejection on the simulator.

There is a special trainer with several degrees of freedom simulating conditions of instrument flying for gaining spatial orientation skills.

Trainee actions under conditions of oxygen starvation (such as in case the aircraft cockpit depressurizes at high altitude) are practiced in a special pressure chamber. Main efforts are directed at studying each trainee's individual reaction when oxygen starvation arises (as a rule this consists of headaches, reduced color perception and so on).

Great significance is attached to centrifuge conditioning. It is believed that pilots in Bundeswehr aircraft can be subjected to g-forces of from seven to nine. Normal blood circulation and blood supply of the brain are disturbed, which in turn can lead to loss of consciousness and the pilot's death. During the conditioning trainees gain skills in using anti-g suits and learn special exercises. Their condition is monitored continuously with the help of sensors placed in the anti-g suits. If necessary the practice session is aborted, the centrifuge is stopped (it takes 4-5 seconds for this with an eightfold acceleration), and urgent medical assistance can be given in just 20 seconds.

According to the foreign press, the FRG Air Force Aviation Medicine Institute promotes the prevention of air mishaps and thus increases flight safety. In this work it actively cooperates with establishments of similar profile in other NATO countries.

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#### **Ocean and Sea Lines of Communication in U.S. and NATO Plans**

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VOYENNOYE OBOZRENIYE in Russian  
No 12, Dec 1988 (signed to press 7 Dec 88) pp 53-59

[Conclusion<sup>1</sup> of article by Vice Admiral (Ret) I. Khurs]

[Text] The first part of the article showed the importance of ocean and sea lines of communication [LOC] to the United States and its allies in aggressive blocs with consideration of the experience of World War II and

subsequent military conflicts, and revealed the views of foreign specialists on the problem of protecting LOC in a future war should it be unleashed by the imperialists. Questions directly related to protecting ocean and sea LOC are considered below based on open foreign press materials.

Specific views on protecting LOC already have formed at the present time as a result of numerous studies conducted in the West. These questions are intensively worked out during joint and national exercises of navies of NATO countries in the Atlantic and in European waters and during American-Japanese and American-South Korean exercises in the Pacific. The "forward positions" concept has developed into a doctrinal provision of national strategy of the United States and NATO, the primary objective being to cut enemy naval forces off from sea LOC and prevent them from deploying into the ocean.

In accordance with existing views, before the onset of combat operations it is planned to concentrate major groupings of naval forces, tactical aviation and ground forces in operationally important areas adjoining the territories of the USSR and other socialist countries for accomplishing missions of defeating the Soviet Navy and navies of its allies and preventing their egress into the ocean zone. To attain this objective it is proposed to conduct various kinds of combat operations, with the principal place given to the naval blockade. The blockade is to include mixed forces—carrier forces, ship striking forces, antisubmarine forces, submarines and aviation—operating with the support and under cover of continental systems of air defense, reconnaissance, and EW as well as shore sonar reconnaissance and surveillance resources.

According to views existing in the West, proposed zones of blockade operations have appreciably expanded geographically in comparison with World War II times. They include zones of the Norwegian Sea and of the Black Sea, Baltic and Gibraltar straits. It is envisaged that the alignment of blockade forces in the zone will be echeloned in depth. The "first strategic line of defense" runs immediately off the bases and basing facilities of our fleets with the objective of bottling them up. American military specialists believe that modern blockade operations provide for the destruction of enemy ships attempting to put to sea. Under conditions where the enemy will have air supremacy in the vicinity of his coast, the tactics of controlling the departure of ships from bases will involve chiefly the employment of mine ordnance and submarines.

The second form of blockade operations is "control of choke points." It is believed in the West that choke points can be "the best place for combat contact with the enemy." The advantage of this method lies in the opportunity for employing forces which cannot preserve combat-effectiveness in operations off the enemy coast. To

ensure effectiveness of blockade operations in the Norwegian and Barents seas, deployment of forces is envisaged on the following barriers: Spitzbergen-Northern Norway; Greenland-Iceland-Faeroes Islands-Shetland Islands-Southern Norway; and on approaches to basing facilities. A zone is set aside between the barriers for operations of the NATO Striking Fleet. Command authorities of the U.S. and NATO navies consider prevention of the penetration of Northern Fleet ships into the North Atlantic across those barriers ("strategic lines") to be the principal option of operations for which the forces must prepare in peacetime.

It is planned to conduct naval blockade operations by naval forces in close coordination with air and ground forces, which permits delivering effective strikes against sea and air bases from sea, air and land; preventing departure of ships from bases; and destroying aircraft at airfields and in the air.

But U.S. strategy in forward zones provides for more than just organizing a blockade. Opinions are being expressed about the need to take steps which would limit enemy capabilities of allocating forces for operations on the LOC. Some American military specialists believe that employment of submarines in forward areas will be preferable to their deployment on antisubmarine barriers, since then they will have greater opportunities for selecting targets and will be able to accomplish many-sided missions right up to landing sabotage teams for destroying ships at berths or in shelters. A discussion is going on over the advisability of directing efforts of some of the nuclear powered multipurpose submarines for warfare against SSBN's and their defending forces in defended zones ("bastions"), within which enemy nuclear powered missile submarines will operate during a war. It is believed that in this manner American submarines "will be able to tie up a considerable number of nuclear powered submarines intended for defending bastions'."

In evaluating possible operations of friendly forces at "forward positions," western specialists conclude that they will not be able to completely deprive the enemy forces, and above all submarines, of the opportunity of penetrating into the ocean for operations on the LOC. This conclusion is confirmed by results of exercises conducted in the postwar period. The experience of World War II also is considered, which indicates that 251 submarines, or only 35 percent of all submarines lost by Germany in the war, were destroyed in the principal blockade zones. Even in the period of blockade of German bases in the Bay of Biscay (1941-1944), when conditions were more favorable for the British, the latter sank only 50 fascist submarines even though German submariners made a total of 2,425 transits of the blockaded zone.

In postwar times the West is giving great attention to developing modern methods of protecting ocean and sea LOC from forces which have penetrated into the ocean

through blockaded zones, i.e., "which have ended up outside the blockade ring." At the same time, the question is being decided about relative proportions of forces earmarked for conducting blockade operations and being employed for immediate protection of ocean LOC.

Immediate protection of the LOC falls in the category of defensive operations and has as its mission the defense of vessels at sea proceeding in convoys or alone, when vessels are at loading (unloading) points, and in areas where convoys are being formed or disbanded.

It is believed that the convoy system remains one of the principal forms for supporting ocean or sea movements during a war. Convoys are classified as follows: by number of ships as small (up to ten), medium (up to 30), large (up to 90) and gigantic (over 90); by speed as fast (over 20 knots), medium speed (around 15 knots) and slow (up to 10 knots); and by the nature of cargoes being transported as troop, cargo and mixed. Disposition of vessels in columns so that the width of convoy frontage is greater than its depth is considered the most advantageous. The distance between columns averages 0.5 nm and the distance between vessels 0.3 nm. The use of dispersed convoys also is not precluded, such as when there is a threat of enemy use of nuclear weapons or when there are transports in the convoy with especially valuable cargo. In this case the distance between columns can be several nautical miles and the distance between vessels with valuable cargoes can be up to several tens of nautical miles.

Areas for forming and disbanding ocean convoys can be up to 300 nm from shore. According to calculations of NATO specialists 10-12 escort ships, including 2-4 equipped with sonar with long towed arrays, must be assigned to a large convoy.

The antisubmarine defense of a convoy is echeloned in three zones. The near zone is formed by ships of the close escort, operating around protected vessels at a distance of up to 2-3 nm. Forming a continuous sonar surveillance zone, the ships accomplish the mission of preventing enemy submarines from launching a torpedo attack against the vessels. The middle zone is formed for advance detection and destruction of submarines before they take up salvo positions. Ship hunter-killer forces will operate here in threatened sectors at a distance of 25-35 nm from the protected transports. To improve reliability of antisubmarine defense it is deemed necessary to organize the hunting and killing of submarines in the far zone (up to 150-200 nm from the convoy), to which a carrier striking force, carrier hunter-killer force (Fig. 1 [figure not reproduced]), ship hunter-killer forces, and land-based patrol aircraft can be assigned depending on the situation. Nuclear powered multipurpose submarines can be committed for operations in the middle and far zones.

In the assessment of foreign specialists, the accepted system for organizing antisubmarine defense of a convoy can provide for detecting and attacking nuclear powered submarines of early types (characterized by an increased noise level), which have to enter the protected zones to employ weapons against vessels. It is believed that the strongest elements of the antisubmarine defense system are the carrier striking force and ships with long towed arrays. The carrier striking force is capable of exercising "complete control over the space around the striking force" and "transports, tankers, as well as amphibious forces" can "hide" under this cover. Ships having sonar with long towed arrays can detect submarines at considerably greater distances than those equipped with sonar with keel-mounted arrays. Because of this, ships with long towed arrays introduce stability of monitoring the undersea situation (regardless of sea and weather conditions) in a convoy antisubmarine defense system, accomplishing missions not only of detecting submarines, but also of providing tactical vectoring and target designation for other ships and aircraft of the combat escort.

Air defense of convoys is accomplished by ships in their zones of operation in the interests of antisubmarine defense. The near air defense zone is provided by ships of the close escort and by the anti-aircraft weapons of transports, on which self-contained containerized weapon systems, including anti-aircraft gun mounts and passive jamming systems, are installed. The middle air defense zone is organized by ships of the close escort and the outer screen. The most important convoys can be screened by carrier striking forces, which form the outer air defense zone. Missions of the escort forces and their composition by zones can change depending on the degree of threat. It is believed that missile attacks by submarines, above all using antiship missiles at short ranges, present the greatest threat to ocean convoys. Close-in penetration to convoys by groups of enemy aircraft through sectors of an echeloned air defense system also is assumed.

Antimine defense of convoys is organized in the vicinity of ports, in places where convoys form and disband, and when they transit choke points. Minesweeping forces (ships, Fig. 2 [figure not reproduced], helicopters, shore surveillance system posts), which are part of naval commands in corresponding zones or areas, are used for this purpose. Great importance is attached to minesweeping operations in the system of LOC protection. Such operations are constantly practiced in exercises of allied naval forces and national fleets of NATO countries conducted in the Baltic, Mediterranean and Black seas, in straits and off the shores of the North Sea, and off the ports and bases of Norway. Submarines, aircraft and surface combatants can be mine threat platforms. An antimine defense is provided by conducting surveillance-type minehunting with the objective of determining the presence of mines and the boundaries of where they are laid, after which the destruction of emplaced minefields (clusters) as well as the escort of ships and vessels behind sweeps is organized.

Transits by lone vessels are supported by special measures in the vicinity of ports and choke points; in other areas these measures are carried out under the plan for maintaining the operational regime in the theater. It is believed that when fast lone vessels are used for moving cargoes across the ocean, expedient camouflage measures should be taken which can seriously hamper enemy activity to intercept them.

In searching for ways to improve the system of protecting sea LOC in postwar times, the NATO leadership developed new methods for protecting LOC which are intended for implementation along with the close convoy escort system described above. The basis of the "protected sea LOC zone" method is to win and maintain sea and air supremacy in a designated part of the ocean by a specially created naval force interworking with groupings of other branches of the armed forces to accomplish missions. The activity of such forces relies on a developed network of naval bases, airfields, and reconnaissance and surveillance systems. One can judge the method's content, composition of forces used, and missions they accomplish from the following example.

In Exercise Ocean Safari-83 a zone protected against "enemy" submarines, surface combatants and air forces was established on approaches to the Bay of Biscay and the coast of Portugal. The mission of winning and maintaining supremacy was accomplished by the NATO Striking Fleet in coordination with tactical aircraft of NATO countries and early warning and control aircraft. The fleet included four carriers (U.S. "John F. Kennedy," French "Foch," and UK "Hermes" and "Illustrious") and NATO's Standing Naval Force Atlantic. A total of some 90 ships and over 300 aircraft were brought in to take part in the exercise. In the "prewar time," operations of the NATO Striking Fleet began from an area east of the Azores for uncovering the surface and undersea situation and pressing "enemy" surface combatants and submarines from communication routes from the Azores to the west coast of Europe. With the beginning of combat operations that force delivered strikes against "enemy" forces at sea: Tactical aircraft operating from coastal airfields attacked naval targets at a distance of up to 400 km from shore. Two British Royal Navy carrier hunter-killer forces, several nuclear powered multipurpose submarines and at least five ship hunter-killer forces as well as land-based patrol aircraft were used to engage submarines in the "protected sea LOC zone." Zone air defense was provided by deck-based aircraft and by land-based fighter aircraft, surface-to-air missile systems and ship guns. Personnel and resources of NATO's allied air defense system in Europe were used in support of air defense of the zone. In the assessment of the exercise leadership, airborne targets were detected and intercepted at a distance of 800-900 km from the protected vessels.

Antimine defense of basing facilities, vessel receiving points, and areas of convoy formation (disbandment)

was provided during combat operations in the "protected sea LOC zone," and vessels were escorted behind sweeps.

The "moving zone of supremacy" method is envisaged for defense of convoys on transits in a wide ocean zone. It provides for winning complete sea supremacy and air superiority along convoy routes. The method is based on an object-zone principle of defense. Close escort by surface combatants (Fig. 3 [figure not reproduced]) operating in a circular formation at distances up to 6 nm from the escorted vessels is organized in the close zone. Ship hunter-killer forces which form the middle defense zone operate in threatened sectors 25-35 nm from the center of the convoy. Depending on the situation, the outer defense zone is provided by screening forces (carrier striking forces, carrier hunter-killer forces, ship hunter-killer forces, nuclear powered multipurpose submarines) operating in threatened sectors at a distance of 150-200 nm from the convoy. In the opinion of western specialists, using this method of defense in exercises ensured winning sea and air supremacy in a convoy path 500-600 nm wide and up to 25 km in altitude.

Creation of antisubmarine barriers with ship hunter-killer forces and land-based patrol aircraft in the convoy's path or in zones between paths is used to improve reliability of antimine defense of convoys in the exercise practice of NATO Allied Naval Forces. This method of defense has been called the "protected sea lane" in the West. In Exercise Ocean Safari-83 an antisubmarine barrier of surface combatants was formed extending up to 300 nm.

Organization of sea LOC protection in wartime envisages taking a number of special preliminary measures with the appearance of the threat that military operations will be unleashed. The primary measures may be as follows:

- Conversion of the merchant fleet of bloc countries and their allies from a peacetime to a wartime footing, the basis being introduction of naval control over shipping, deployment of military and civilian shipping management agencies, and creation of an allied fleet of transport vessels;
- Evacuation and dispersal of transportation resources from major ports and areas dangerous for shipping;
- Timely recall of vessels from ports of hostile countries and their removal to safe areas;
- Introduction of a vessel convoying system;
- Organization of reliable defense of transport loading or unloading ports, anchorages, transportation hubs, and convoy formation (disbandment) areas;
- Armament and refitting of merchant vessels.

Wartime naval control agencies are established on the basis of sea transportation agencies existing at reduced strength in peacetime on the staffs of NATO and national commands. In peacetime the Naval Control of Shipping Organization performs the following missions:

- Monitoring and continuously evaluating the situation in ocean and sea theaters and developing proposals for the command authority for ensuring navigation safety of vessels or abolishing previously instituted measures in connection with a change in the situation in individual areas;
- Developing measures for protecting vessels against subversive and piratic actions in ports and when operating in choke points, and monitoring to see that such measures are made known and executed;
- Elaborating problems of organizing the LOC protection system;
- Coordinating elements of the LOC protection system with interested organizations;
- Drawing up directives to departments and organizations on preparing to take measures to ensure protection of shipping and giving them necessary assistance in drawing up documents of execution;
- Organizing the practice of LOC protection problems.

In wartime naval control agencies resolve problems of forming convoys, organizing their passage, determining convoy routes, and supplying convoys and lone vessels with information on the situation.

Overall direction and planning of measures for protecting ocean LOC of the United States and NATO in the Atlantic rests with the NATO Supreme Allied Commander Atlantic, who organizes fulfillment of these functions through main commands of NATO Allied Naval Forces in the zones.

Responsibility for organizing sea LOC protection in European waters rests with the Supreme Allied Commander Europe. In the Pacific zone the U.S. CINCPACFLT is responsible for organizing protection of ocean and sea LOC.

Supreme allied commanders of bloc armed forces in sectors as well as the U.S. CINCPACFLT accomplish missions of LOC protection through corresponding command authorities in the zones, at whose disposal the necessary forces are placed.

The most important role in organizing military transportation activities in the interests of supporting strategic mobility of the U.S. Armed forces rests with the Military Sea Transportation Service established in 1949 and redesignated the Military Sealift Command [MSC] in 1970. Its principal missions are to support movements of

troops and logistic items for the U.S. Armed Forces in peacetime, develop and implement plans for building up sea movements in case of a state of emergency or war, and carry out measures for improving the Merchant Marine's mobilization readiness. The MSC also includes vessels being used for ocean and space research, missile tracking, and weapon testing.

Regional MSC commands and departments are located both on U.S. territory and abroad. There are representatives of this service in many world countries, and the MSC network can be increased if necessary. For example, an MSC department was opened in Saigon in 1965 in support of combat operations in the period of U.S. aggression in Vietnam, and its strength reached 100 persons. It had some 10,500 civilian sailors and over 400 servicemen directly subordinate to it. In the period of local military conflicts the scale of shipping in the interests of armed forces increased considerably. For example, during the American aggression in Korea (1950-1953), the MSC delivered some five million persons and 22.4 million tons of fuel and lubricants to the country. The mean intensity for shipping military freight to Korea was over 30,000 tons per day. During the war in Vietnam the number of vessels delivering freight to the theater was brought to 400 and the monthly volume of cargoes they carried reached 1,759,000 tons in 1969.

Special communication and information systems are being developed and adopted for accelerating the recall of vessels of private companies to the United States. For example, back in 1977 development began on the CALSTAT system, designed to provide the Navy command and MSC with prompt information about the status of vessels and to plan their time of arrival in port and the current status of stores for each vessel. The USMER system is used for the "emergency recall" of vessels and for selecting them to be sent to a port of loading in the United States. It is planned to use the merchant fleets of NATO countries as well as of other states not included in this bloc, especially Japan, in support of urgent U.S. military shipping when necessary.

A centralized form of maritime transportation management has been established and is functioning at the NATO level. The Senior Civil Emergency Planning Committee is the supreme NATO agency for developing plans for preparing civilian sectors of the economy of bloc member countries for wartime conditions. One of its subcommittees, the Planning Board for Ocean Shipping, handles the planning of maritime shipping. It includes representatives of shipping organizations of all NATO countries which place their vessels at the disposal of the bloc command authority. In case of war, this board becomes a directive agency, the Defense Shipping Authority, consisting of the Defense Shipping Council and the Defense Shipping Executive Board. The Council directs the activity of the Executive Board, studies the status of the merchant fleet, and determines principles of its use in accordance with directives of supreme NATO agencies.

The Executive Board, consisting of two subcommittees (an American subcommittee in Washington and a European subcommittee in London), implements Council decisions, allocates personnel and resources according to tasks, and determines conditions for financing and operating vessels.

Along with establishment of NATO-level shipping management agencies, national governmental maritime transportation agencies also continue to function; in case of war they assume direction of a given country's merchant fleet.

A department of the Naval Control of Shipping Organization which is responsible for protecting ocean and sea LOC exists in the NATO military organization. In peacetime this department coordinates all matters relating to protection of shipping, draws up necessary guidance documents, and collects information on the presence of vessels in the ocean. In wartime it arranges the formation of convoys, specifies their routes, and monitors the passage of vessels on assignment.

The following sources of transportation resources for military purposes can be used under emergency conditions: MSC and national defense reserve fleet vessels, merchant vessels flying the U.S. flag, vessels flying "flags of convenience" but belonging to various U.S. shipowner companies, as well as chartered vessels flying foreign flags.

On the whole, questions of protecting ocean and sea LOC hold a special place in military plans of the United States and the NATO bloc. In the assessment of the bloc military-political leadership, this is dictated by the vital importance to western countries of the delivery of military and economic cargoes by maritime transportation. In elaborating the theory and practice of protecting LOC, primary attention is given to accomplishing missions of preventing the Soviet Navy from deploying into the ocean. A very important role in accomplishing this

mission is given to the naval blockade. Use of powerful striking and antisubmarine forces, air defense forces, as well as their combat and logistic support personnel and resources is envisaged for operations in forward zones of ocean theaters in conducting such a blockade.

#### Footnotes

1. See beginning of article in ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 11, 1988, pp 49-55—Ed.

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#### Destroyers

18010378n Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 12, Dec 1988 (signed to press 7 Dec 88) pp 60-66

[Part 1 of article by Capt 1st Rank Yu. Petrov]

[Text] Destroyers, which are surface combatants, are categorized abroad as escort ships. They hold an appreciable place in the navies of leading capitalist countries and are inferior in numbers only to the frigate type. Destroyers are part of the escort providing for the defense of carrier and ship striking forces, landing detachments and convoys. They combat enemy surface and undersea forces, provide fire support to an amphibious assault force landing and to the maritime flanks of ground troops, participate in defense of sea and ocean LOC, and deliver missile and gun strikes against shore installations.

Judging from data of the reference "Jane's Fighting Ships," the navies of foreign countries have some 270 destroyers as of late 1988, of which over 60 have been built in the last ten years. Up to 20 ships of various classes are in different stages of construction in the United States, France, Italy, Canada and Japan. The principal specifications and performance characteristics of the most modern ships of this type are given in Table 1.<sup>1</sup>

Table 1—Modern Destroyers of Navies of Capitalist States

Ship Class (Pennant Numbers) —Number Commissioned (Under Construction), Year Commissioned	Displacement, Tons: Standard/Full	Principal Dimensions, m: Length, Beam, Mean Draft (Maximum)	Power Plant Output, hp/Maximum Speed, knots	Range, nm/At Speed, knots	Crew (Officers)	Armament <sup>1</sup>
1	2	3	4	5	6	7
United States						
"Arleigh Burke" <sup>2</sup> (DDG 51-54 and so on)—0(4), 1990-	8,400	142.1, 18.0, 6.1 (9.1)	100,000/30	5,000/20	303(23)	2 Mk 41 Mod 2 VLS for 90 (1x61 and 1x29) missiles; Tomahawk cruise, Standard SAM, and ASROC antisub- marine; Harpoon antiship missile system—2x4; 127- mm gun mount—1x1; 20- mm AA system—2x6; 324- mm TT—2x3; helicopter pad
"Kidd" <sup>2</sup> (DDG 993-996) —4, 1981-1982	6,700/8,300	171.6, 16.8, 6.2 (9.1)	80,000/33	6,000/20 or 8,000/17	346 (24)	Harpoon antiship missile sys- tem—2x4; Terrier SAM sys- tem (52 Standard SAM)/AS- ROC antisubmarine missile system (16 missiles)—2x2; 127-mm gun mount—2x1, 20-mm AA system—2x6; 324-mm TT—2x3; helicop- ters—2
"Spruance" <sup>3</sup> (DD 963-992, 997) —31, 1975-1983	6,420/7,810	171.7, 16.8, 5.8 (8.8)	80,000/33	6,000/20	324 (20)	Mk 41 VLS for Tomahawk cruise missile and ASROC antisubmarine missile—1x61 (on DD 963 and 991); <sup>4</sup> Tom- ahawk cruise missile—2x4 (on DD 974, 976, 979, 983, 984, 989 and 990); Harpoon antiship missile system— 2x4; NATO-Sea Sparrow SAM system—1x8 (except DD 963 and 991) and RAM (on DDG 971); ASROC anti- ship missile system—1x8 (except DD 963 and 991); <sup>4</sup> 127-mm gun mount—2x1; 20-mm AA system—2x6 (on majority of ships); <sup>5</sup> 324-mm TT—2x3; helicopters—2
Great Britain						
"Sheffield" <sup>2</sup> (D 86-92, 95-98, <sup>6</sup> 108) —12, 1976-1985	3,500/4,100	125.0, 14.3, 4.2 (5.8)	50,000/30	4,000/18	253 (24)	Sea Dart SAM system—1x2 (22 SAM); 114-mm gun mount—1x1; 30-mm gun mount—2x2; 20-mm gun mount—2x1; 324-mm TT— 2x3; helicopter



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1	2	3	4	5	6	7
France						
"Cassard" <sup>2</sup> (D 614-617) —1 (3), 1988-1994	4,300	139.0, 14.0, 5.7	42,400/30	8,000/17	240 (.)	Exocet antiship missile system—2x4 (MM-40 antiship missile); Tartar SAM system—1x1 (40 Standard-1 MR SAM); Sadral SAM system—2x6 (Mistral SAM); 100-mm gun mount—1x1; 20-mm gun mount 2x1; 533-mm TT—2x1 (10 L5 torpedoes); helicopter
"Georges Leygues" <sup>2</sup> (D 640-646) —6 (1), 1979-1990	3,830/4,170	139.0, 14.0, 5.7	52,000/30	9,500/18	216 (15)	Exocet antiship missile system—4x1 (MM-38 antiship missile on D 640 and 641 and MM-40 on others); Naval Crotale SAM system—1x8; Malafon antisubmarine missile system—1x1 (13 missiles); 100-mm gun mount—1x1; 20-mm gun mount—2x1; 533-mm TT—2x1 (10 L5 torpedoes); helicopters—2
Italy						
"Animoso" <sup>2</sup> (D 560, 561)—0 (2), 1990	4,400/5,250	135.6, 16.1, .	55,000/31	7,000/18	400 (.)	Teseo antiship missile system—4x2 (Otomat Mk 2 antiship missile); Tartar SAM system—1x1 (Standard-2 SAM); Albatros SAM system—1x8 (Aspide SAM); 127-mm gun mount—1x1; 76-mm gun mount—3x1; 324-mm TT—2x3; helicopters—2
Canada						
"Halifax" <sup>2</sup> (DDH 330-335)—0 (3) <sup>7</sup> , 1989-1992	3,870/4,700	133.5, 16.4, 4.6	50,000/29	4,500/15	225 (.)	Harpoon antiship missile system—2x4; Sea Sparrow SAM system (VLS)—2x8 (28 SAM); 57-mm gun mount—1x1; 20-mm AA system—1x6; 324-mm TT—2x3; helicopters—2

Table 1—Modern Destroyers of Navies of Capitalist States

Ship Class (Pennant Numbers) —Number Commissioned (Under Construction), Year Commissioned	Displacement, Tons: Standard/Full	Principal Dimensions, m: Length, Beam, Mean Draft (Maximum)	Power Plant Output, hp/Maximum Speed, knots	Range, nm/At Speed, knots	Crew (Officers)	Armament <sup>1</sup>
1	2	3	4	5	6	7
Japan						
DDG 173 <sup>2</sup> —0 (1), 1993-	7,200/8,500	158.0, 17.5, 6.0	100,000/30	6,000/20		2 Mk 41 Mod 2 VLS for 90 (1x61 and 1x29) missiles (74 Standard-2 MR SAM and 16 ASROC antisubmarine missiles); Harpoon antiship missile system—2x4; 127-mm gun mount—2x1; 20-mm AA system—2x6; 324-mm TT—2x4; helicopter
"Hatakaze" <sup>2</sup> (DDG 171, 172)—2, 1986-1988	4,550/5,500	150.0, 16.4, 4.8	72,000/30	./.	260 (.)	Harpoon antiship missile system—2x4; Tartar SAM system (40 Standard SAM)—1x1; ASROC antisubmarine missile system—1x8; 127-mm gun mount—2x1; 20-mm AA system—2x6; 324-mm TT—2x3; helicopter
"Asagiri" <sup>2</sup> (DD 151-158)—4 (4), 1988-1991	3,500/4,200	136.5, 14.6, 4.5	54,000/30	./.	230 (.)	Harpoon antiship missile system—2x4; Sea Sparrow SAM system—1x8; ASROC antisubmarine missile system—1x8; 76-mm gun mount—1x1; 20-mm AA system—2x6; 324-mm TT—2x3; helicopter
"Hatsuyuki" <sup>2</sup> (DD 122-133)—12, 1982-1987	2,950/3,700	130.0, 13.6, 4.1	45,000/30	./.	190 (.)	Harpoon antiship missile system—2x4; Sea Sparrow SAM system—1x8; ASROC antisubmarine missile system—1x8; 76-mm gun mount—1x1; 20-mm AA system—2x6 (except DD 122 and 123); 324-mm TT—2x3; helicopter
"Tachikaze" <sup>2</sup> (DDG 168-170)—3, 1976-1983	3,900/4,800	143.0, 14.3, 4.6	60,000/32	./.	250 (.)	8 Harpoon antiship missiles (only on DDG 170); Tartar SAM system—1x1 (40 Standard RIM-66B SAM); ASROC antisubmarine missile system—1x8; 127-mm gun mount—2x1; 20-mm AA system—2x6 (on DDG 168 and 169); 324-mm TT—2x3

Table 1—Modern Destroyers of Navies of Capitalist States

Ship Class (Pennant Numbers) —Number Commissioned (Under Construction), Year Commissioned	Displacement, Tons: Standard/Full	Principal Dimensions, m: Length, Beam, Mean Draft (Maximum)	Power Plant Output, hp/Maximum Speed, knots	Range, nm/At Speed, knots	Crew (Officers)	Armament <sup>1</sup>
1	2	3	4	5	6	7
"Shirane" <sup>8</sup> (DDH 143-144)—2, 1980-1981	5,250/6,800	159.0, 17.5, 5.3	70,000/32	/. .	350 (.)	Sea Sparrow SAM system—1x8, ASROC antisubmarine missile system—1x8; 127-mm gun mount—2x1; 20-mm AA system—2x6 (only on DDH 144); 324-mm TT—2x3; helicopters—3

1. Number of missile systems (antiship, surface-to-air [SAM], antisubmarine), vertical launch systems [VLS], gun mounts, and antiaircraft [AA] systems; number of launchers or barrels in them; and number of torpedo tubes [TT] are denoted by digits separated by a multiplication sign.
2. Guided missile ships (including "Sheffield"-Class guided missile destroyer—see Fig. 4 [figure not reproduced], "Hatakeze"-Class—see color insert [color insert not reproduced]).
3. American specialists do not categorize "Spruance"-Class destroyers as guided missile ships.
4. It is planned to install the VLS Mk 41 in place of the NATO-Sea Sparrow SAM system and ASROC antisubmarine missile system on the majority of ships (except DD 974, 976, 979, 983, 984, 989 and 990).
5. It is planned to install the Vulcan-Phalanx AA system aboard all ships of this class.
6. Ships D 95-98 have a full displacement of 4,775 tons, a length of 141.1 m, a beam of 14.9 m, and a crew of 301, including 26 officers.
7. "Halifax"-Class guided missile destroyers previously were categorized as guided missile frigates in the foreign press.
8. Helicopter-carrying destroyers.

The broad range of missions accomplished by destroyers predetermined the great diversity of their classes and design characteristics. In addition, national shipbuilding traditions and features dictated by the military-geographic situation and economic capabilities of individual countries in turn promoted an increase in differences in their architecture, design and armament. The foreign press notes, however, that in the last decade there have been more noticeable trends toward a standardization of ships of this type and a coming together of their architectural forms, basic specifications and performance characteristics, and design solutions. Computer-aided design permits evaluating the seaworthiness of ships and effectiveness of weapon employment with different hull design options faster and with less cost. Primary attention is given not so much to providing great speed in the absence of wave action (in contrast to the past) as to increasing seaworthiness, speed, and the capability of employing weapons under difficult, unfavorable meteorological conditions. Studies conducted by U.S. Navy specialists showed that the seaworthiness of ships can be substantially improved through more improved hull lines with a large waterplane area (especially in the forebody), V-shaped sections, a flare of the side along the ship's full length at the waterline level, an aft end of moderate beam, and a pointed, sharply raised clipper bow.

The ship architecture of navies of other NATO countries and Japan also basically corresponds to those trends, although it has certain typical features. For example, British Royal Navy destroyers have a rather narrow submerged stern and relatively shallow draft. The French Navy uses a hull with a lower cruiser stern, considerable unit elongation, and low displacement-to-length ratio compared with ships of other countries close to them in characteristics. The architecture of Italian ships is distinguished by a broad transom stern and straight-bilge lines with a strong curvature in the lower part of the hull. Form factors for destroyers are within the following limits: midship coefficient 0.744-0.9, waterplane area coefficient 0.7-0.76, displacement coefficient 0.442-0.588, longitudinal coefficient 0.594-0.62, and unit elongation 8-10.

Hulls are framed in a longitudinal system and have deep frames and an inner bottom for the greater length of the ship. They are made either flush-deck or with a long forecastle erection. Frame spacings on U.S. destroyers are 2.1-2.4 m (they are somewhat less in ships of European countries), and the distance between stringers is 0.6-0.8 m. There are two pillars on each frame. Hulls are divided by watertight bulkheads into 15-17 compartments. New hull forms in combination with stabilization

systems in the form of bilge keels and side rudders reduce the amplitude of rolling and pitching and consequently decrease upper deck wettability, promote a decrease in slamming, and permit maintaining high speed without fear of damaging the fairing of the bow (keel-mounted) sonar array. The majority of new-construction ships have a steel superstructure. The superstructure of the French "Cassard"-Class<sup>2</sup> guided missile destroyers is made of aluminum alloys to reduce weight and increase metacentric stability. That superstructure has high inflammability, however, as shown by the experience of combat operations in the South Atlantic during the Anglo-Argentine military conflict over the Falkland (Malvinas) Islands.

New destroyers are being designed as a comprehensive weapon system, including hull, mixed armament, and equipment. There is a fixed hangar for helicopters in the after part of many ships with an adjoining takeoff-landing pad. Great attention in project development is given to the accommodation of weapons and various subsystems as well as to conditions under which they function. Above all this concerns the electronics, which are assuming more and more importance in the overall ship equipment complex. The considerable number of radiotechnical devices and antennas which create mutual interference requires creation of optimal conditions for their operation.

To an ever-increasing degree, standardization is promoting an acceleration in building ships, an improvement in quality and a reduction in cost of construction and installation work. In the United States ships are built on flow lines by the block-section method from standard modules having a high degree of saturation of the sections with set-completing equipment. Provision is made in designing ships for creating that hull and construction architecture which permits modernization without extensive disassembly work (as a rule, ships undergo two modernizations over a 25-30 year lifetime).

New destroyers are designed with consideration for their operation in different climatic zones and under conditions where weapons of mass destruction are employed. All internal spaces are supplied with air conditioning systems and collective protection systems in the form of airtight citadels with filters on ventilation lines and with maintenance of positive internal pressure, and there are water screen systems and decontamination stations. Ship buoyancy is preserved when up to any three adjacent compartments are flooded. The system of collective protection against weapons of mass destruction is realized to the full extent in projects of ships of the "Arleigh Burke" (USA) and DDG 173 (Japan) classes.<sup>3</sup> Internal spaces are broken into four protective zones, each of which has air locks with interlocked doors providing for maintenance of positive pressure ( $0.14 \text{ kg/cm}^2$ ) in the internal spaces. Measures are being developed to reduce the effect of the electromagnetic pulse and blast wave. The hull and superstructure of the "Arleigh Burke"-Class ship (Fig. 1), including radar (AN/SPY-1D) antennas,

are designed for an overpressure of  $0.5 \text{ kg/cm}^2$  in an explosion, which is more than double the previously accepted value in the U.S. Navy ( $0.21 \text{ kg/cm}^2$ ). There is a continuous passage for the entire length of the ships which gives the crew an opportunity to man battle stations without emerging onto the upper deck.

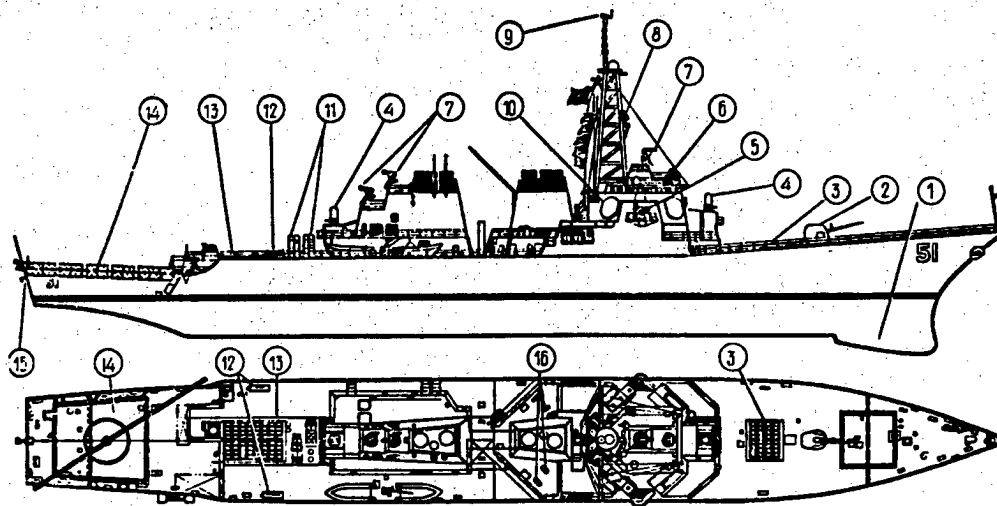
Much attention is given to reducing physical fields, and acoustic and thermal fields above all. This is achieved by using different sound-absorbing devices and coatings as well as low-noise power-generating equipment manufactured under special technology. The thermal field of ships is reduced by insulating hot sections using a system of air cooling of exhaust gases and special devices on smokestacks. "Arleigh Burke"-Class ships are the first in the U.S. Navy in which radar cross-section is substantially reduced as a result of the creation of superstructure architecture with smooth curvatures and use of coatings which absorb the energy of radio-frequency emissions. The main power plant is mounted on sound-insulating foundations and shock absorbing supports. The main engine (gas turbine, compressor, lines) and its sound-insulating casing often are made in the form of a single block (module). France is developing a special supporting frame for the engine to reduce the internal noise level.

An analysis of data in Table 1 indicates a stable growth in standard displacement of destroyers, which already has exceeded 6,000 tons for "Kidd"-Class ships (Fig. 2)<sup>4</sup> of the U.S. Navy. It is expected that it will exceed 7,000 tons for new American and Japanese ships with the Aegis multifunction weapon system. A substantial increase in output of power plants to 70,000-100,000 hp is observed at the same time; this, however, is considerably less than the growth in their displacement. As a result, the speed of destroyers has dropped somewhat in comparison with the past and as a rule is within the range of 30-33 knots. Endurance at an economical speed (17-20 knots) usually is 5,000-7,000 nm and reaches 9,500 nm in "Georges Leygues"-Class ships (Fig. 3).

The majority of destroyers are equipped with underway refueling systems, and Americans additionally have one or two store receiving stations using helicopters. New U.S. Navy ships are equipped with belt conveyors and elevators for transferring cargoes from the upper deck to lower decks and moving them around the ship. One of the conveyors provides for horizontal displacement of cargoes along the ship's entire length from bow to stern.

The modular design of equipment installed on many ships, above all American, British and Japanese, permits using the unit repair method and quickly replacing unserviceable units and assemblies by personnel of the ship and of the tender servicing her. Automation of control over ship motion and maneuvering, her power plant, and some weapon and equipment subsystems permitted reducing crew size. This circumstance is evaluated very positively by American specialists. The foreign press notes that 10 percent of the overall cost of a

Fig. 1. Sketch of American "Arleigh Burke"-Class guided missile destroyer



Key:

1. AN/SQS-53C sonar dome
2. Mk 45 127-mm gun mount
3. Mk 41 Mod 2 forward VLS (29 missiles)
4. Vulcan-Phalanx 20-mm AA system
5. AN/SLQ-32(V) EW suite antenna
6. Seafire electro-optical system
7. AN/SPG-62 radar antenna
8. AN/SPS-67 sea search radar antennas

9. TACAN radionavigation system antenna
10. AN/SPY-1D air search radar phased array
11. Harpoon antiship missile system quadruple launchers
12. Mk 32 324-mm triple torpedo tubes
13. Mk 41 Mod 2 after VLS (61 missiles)
14. Helicopter pad
15. Tip of AN/SQR-19 sonar long towed array
16. Mk 36 six-tube launchers of Super RBOC EW system

ship's life cycle and 20 percent of the cost of her upkeep in the navy is spent for personnel pay and allowances. The area of accommodation spaces has a tendency to increase. For example, it is 4 m<sup>2</sup> on "Arleigh Burke"-Class ships and 5.9 m<sup>2</sup> on "Spruance"-Class ships per person, including spaces for messing, administration, crew's accommodations, cabins, galleys, common-use places, and food storage. The height of tween-decks space on ships is as follows: 2.9 m in the United States, 2.6 m in France and 2.4 m in Great Britain. The accommodation spaces on many destroyers are sound-insulated, and through passages have been eliminated through sleeping spaces. Three-tier bunks are grouped in blocks in six-place enclosures separated by screens from

other accommodation spaces. Special places are provided for relaxation and classes. Accommodation spaces are situated where possible in the ship's mid-section and in the superstructure.

Substantial changes have occurred in the armament of modern destroyers. The number of gun mounts and torpedo tubes was reduced sharply and because of this their antiaircraft and antisubmarine weapons were reinforced. At the present time long-, medium- and short-range SAM systems are installed on ships of this type as well as antiship missile systems, antisubmarine missile systems, antisubmarine helicopters and, as a rule, two

Fig. 2. Sketch of U.S. "Kidd"-Class guided missile destroyer

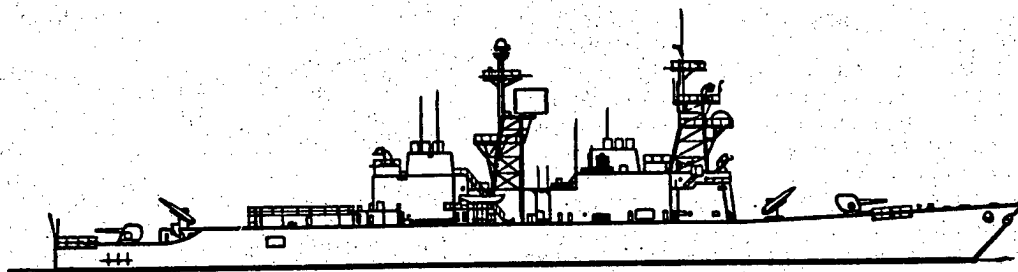
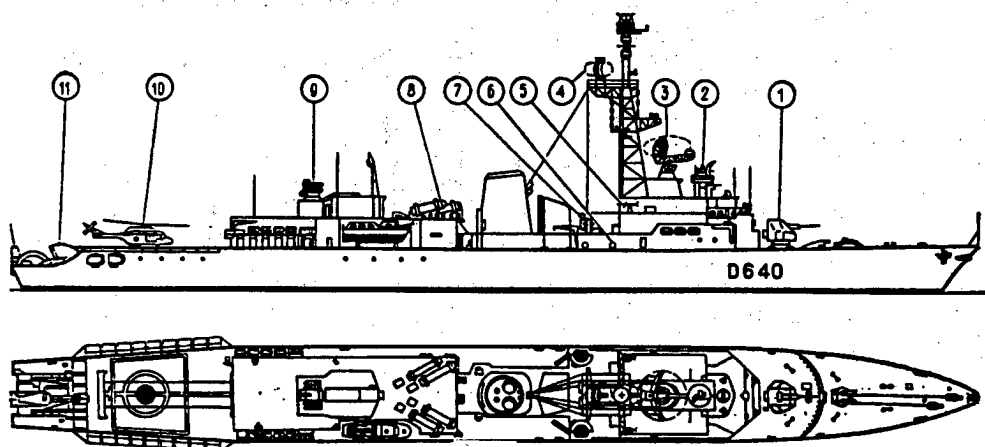


Fig. 3. Sketch of French "Georges Leygues"-Class guided missile destroyer



**Key:**

1. 100-mm gun mount
2. DBRC-32E radar antenna
3. DBRV-26 radar antenna
4. DBRV-51C radar antenna
5. 20-mm gun mount
6. 533-mm torpedo tube

7. Dagaie EW system launcher
8. Exocet antiship missile system launcher
9. Naval Crotale SAM system launcher
10. Lynx WG-13 helicopter
11. DUBV-43B sonar array

triple or four single 324-mm torpedo tubes. Gun armament is represented primarily by general-purpose 100-127-mm mounts. The largest ships are Tomahawk cruise missile platforms.

**Missile weapons**, the basis of combat power of modern destroyers, can include cruise, surface-to-air, antiship and antisubmarine missiles.

"Arleigh Burke" and "Spruance"-Class ships are equipped with Tomahawk cruise missiles of three modifications.<sup>5</sup> BGM-109A missiles with nuclear warhead, a launch weight of 1,200 kg and a flight range up to 2,500 km and BGM-109C with conventional warhead (1,270 kg and 1,250 km) are intended for firing against ground targets, and BGM-109B with HE-fragmentation warhead weighing 454 kg (1,225 kg and 550 km) are intended for engaging surface ships. Their flight speed is around 900 km/hr. The BGM-109A and -109C use a combination guidance system which includes an inertial unit with radar altimeter and TERCOM correction correlation system with terrain contour matching along the flight route. The foreign press notes that the accuracy of a cruise missile's approach to the target is essentially independent of flight range, since the TERCOM compensates for guidance system inertial unit errors increasing over time. BGM-109B missiles also are guided to sea surface targets using a combination system consisting of an inertial unit with radar altimeter (initial and mid-course phase of the trajectory) and active radar homing head. Development of one other modification of the sea-launched Tomahawk cruise missile, the BGM-109D,

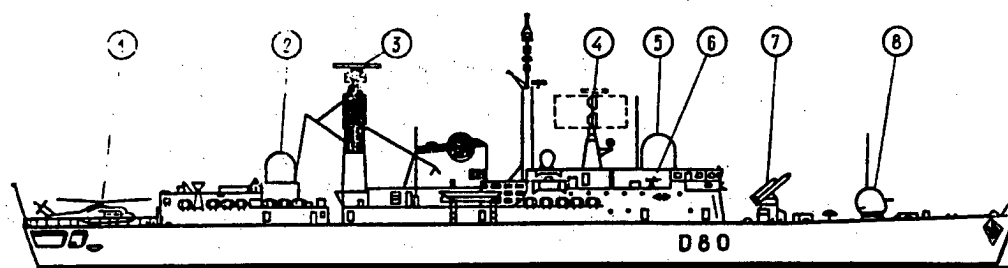
is concluding. In contrast to the BGM-109C, it will be equipped with a cluster warhead containing up to 167 BLU-97B combination-effect bomblets for firing against shore targets.

Tomahawk cruise missiles can be launched from Mk 41 vertical launch systems and (aboard some "Spruance"-Class ships) from two ABL Mk 143 hardened (armored) quadruple launchers. Western specialists consider adoption of VLS in ships' armament as the most important achievement in recent years to increase their combat capabilities. The Mk 41 mount is accommodated beneath the ship's upper deck and can hold four or eight identical modules of eight container cells each, one of which has three technological cells (occupied by a loading device).

The VLS aboard American ships use various container modifications: Mk 14 Mod 0 and Mod 1 for the Tomahawk cruise missile, Mk 13 Mod 0 for the Standard-2 SAM and Mk 15 for the ASROC antisubmarine guided missile (VLS). The first two are 0.915 m longer than the others. According to foreign press reports, use of the VLS permits increasing the survivability of weapon systems, increasing magazine capacity and the nomenclature (variety) of missiles which can be launched, and reducing reaction time and number of attendant personnel.

To improve combat capabilities for destroying enemy surface combatants and vessels, essentially all modern destroyers (except for the British Royal Navy) are equipped with antiship missile systems. The principal specifications and performance characteristics of antiship missiles are given in Table 2.

Fig. 4. Sketch of British "Sheffield"-Class guided missile destroyer



Key:

1. Lynx WG-13 helicopter
2. 909 after radar antenna
3. 992 radar antenna
4. 965 radar antenna

5. 909 forward radar antenna
6. 20-mm gun mount
7. Sea Dart SAM system launcher
8. 114-mm gun mount

Table 2—Principal Specifications and Performance Characteristics of Antiship Missiles of Modern Destroyers

Missile Name and Designation (Developing Country), Year Operational	Weight, kg: Launch/Warhead (Type Warhead)	Missile Dimensions, cm: Length (Overall) x Air-frame Diameter x Wing Span/Guidance System <sup>2</sup>	Flight Range, km: Minimum and Maximum/Flight Speed, Mach	Classes of Principal Destroyer Antiship Missile Platforms
RGM-84A and -84B Harpoon <sup>3</sup> (USA), 1977	667/225 (HE)	457x34x91/combination (I and AR)	13-120/0.85	"Kidd," "Coontz," "Charles F. Adams," "Arleigh Burke," "Spruance," "Lütjens" (FRG); "Halifax" (Canada); "Asagiri," "Hatsuyuki," "Takatsuki," DDG 173, "Tachikaze," "Hatakaze" (Japan)
SSM-1B (Japan), 1990 (under development)	./.	./.	./-150/./	DDG 173 and future ship classes
Exocet MM-40 (France), 1980	850/165 (HE-F)	578x35x110/combination (I and AR)	4-70/0.93	"Cassard" and "Georges Leygues" (some of the ships)
Exocet MM-38 (France), 1971	735/165 (He-fragmentation)	521x35x100/combination (I and AR)	4-42/0.92	"Georges Leygues" (some of the ships), "Aconit," "Suffren," "Tourville," "Duperré," "Hamburg" (FRG)
Otomat Mk 2 (Italy), 1983	770/210 (SA)	446x46x135/combination (I, RC and AR)	5-80/0.9	"Animoso"

1. Type warhead: HE—high explosive, HE-F—high explosive-fragmentation, SA—semi-armorpiercing.
2. Guidance system: I—inertial, RC—remote controlled, AR—active radar (homing head).
3. The RGM-84C modification also exists with a range of fire around 150 km (operational in 1984).

Harpoon antiship missile systems became the most widespread aboard destroyers. Ordinarily two Mk 141 quadruple launchers are used. The Harpoon missile has an active radar homing head (PR-53/DSO-28) protected against electronic countermeasures, since its operating frequency changes according to random law.

(To be concluded)

#### Footnotes

1. For more details on specifications and performance characteristics of other destroyers of the navies of NATO countries and Japan see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 8, 1987, pp 57-60—Ed.
2. For more details see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 8, 1986, pp 53-55—Ed.
3. For more details see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 12, 1985, pp 84-85; and No 1, 1988, pp 69-70—Ed.
4. For more details see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 2, 1985, pp 82-84—Ed.
5. For more details see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 2, 1982, pp 79-82—Ed.

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#### Italy (Military-Geographic Description)

180103780 Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 12, Dec 1988 (signed to press 7 Dec 88) pp 69-78

[Article by Col A. Alekseyev]

[Text] Italy (the Italian Republic) is situated in the southern part of Europe. The government's foreign policy course, based on the country's membership in western military-political and economic groupings, is aimed at developing close and comprehensive cooperation with West European capitalist states, strengthening economic and military ties with the United States, and maintaining business relations with countries of the Near and Middle East. Italy's ruling circles also are taking certain steps to broaden contacts with socialist states.

Being one of the active participants of the NATO bloc, Italy supports all measures for a further build-up in the combat might of its Armed Forces. It also belongs to very large international organizations such as the United Nations, European Economic Community, Western European Union, Euratom, European Coal and Steel Community and others. In 1986 the country's leadership signed an agreement with the U.S. administration on participation in the notorious "star wars" program. Italy also joined the West European Eureka project advanced by France.

U.S. and NATO military bases have been built and are functioning on the country's territory, detachments of American land-based cruise missiles have been deployed, U.S. Air Force F-16 tactical fighters are based there (Aviano Air Base), U.S. Sixth Fleet ships regularly call on Italian ports, and the island of Santo Stefano has been turned into a basing facility for U.S. Navy nuclear powered submarines. The Italian government gave its consent for stationing American nuclear weapon carrying aircraft near the city of Crotone; they will be rebased there from Spain.

Italy has not fallen behind its NATO partners in military expenditures and is fulfilling the obligation of their annual three percent increase. In 1988 21 trillion lira (1,400 lira was the equivalent of one U.S. dollar) were allocated from the state budget for military purposes, including 9,400 billion for the Army, 5,120 billion for the Air Force and 2,710 billion for the Navy. There were 6,822 billion lira directly allocated for personnel pay and allowances and 5,464 billion for modernization and purchases of weapons and military equipment.

**Physical geographic conditions.** Situated in the Mediterranean Sea basin, Italy includes the Apennine Peninsula, Po Valley, south slopes of the Alps, the island of Sicily, the island of Sardinia and other small islands (Fig. 1).

The country stretches 1,170 km from north to south, the greatest distance from east to west in the central part is 230 km, and its territory comprises 301,200 km<sup>2</sup>. The land border with France, Switzerland, Austria and Yugoslavia has an overall length of 1,864 km. The coastline extends for 7,478 km.

The country is primarily mountainous, with mountains and elevations occupying over four-fifths of its territory (Fig. 2 [figure not reproduced]). The difficult Alps, from 2,000 to 4,500 m high, run through the northern part. Their steep slopes are dissected by narrow, deep gorges. Passes are situated at an altitude of 1,300-2,500 m. The highest point in Western Europe, Mont Blanc (4,807 m) is situated here on the border with France.

The very broken Apennines Mountains 1,500-2,000 m high run along the entire peninsula from north to south. Their slopes are gentle and crests are steep. The Alps and Apennines are separated by the vast Po plain, occupying one-seventh of Italy. Karst forms of relief (conical depressions, caves, sinkholes) are widespread. There are traces of previous volcanic activity and active volcanoes—Vesuvius, Etna, Stromboli, Vulcano. There is also mountainous terrain on the islands of Sicily and Sardinia. Lowlands stretch in a narrow belt along the Adriatic and Tyrrhenian seas.

The seacoasts are not very dissected. In the east to the city of Rimini they are low and marshy, and to the south they are elevated and precipitous. On the west coast steep sections alternate with low sections of coast and there are convenient harbors which can be used for dispersing naval forces.



Fig. 1. Principal elements of Italy's infrastructure



Forests occupy some 20 percent of the country's entire area. Broad-leaved species predominate in the mountains to 500-600 m altitude and there are groves of holly oak and cork oak. Deciduous and coniferous forests (beech, chestnut, oak, spruce, fir) are common at altitudes from 600 to 2,000 m, and subalpine meadows are located further on.

The river network is developed basically in the northern part of the country, where the Po River, largest in Italy, runs (Fig. 3 [figure not reproduced]). Together with tributaries and canals, it forms a unified navigable system. The majority of other rivers have a mountainous character, they are nonnavigable, and channels are dammed. There are many lakes in the foothills of the Alps. As a rule, there are floods in the spring and fall.

Soils on the Po plain are brown wood soils, chestnut soils are found in the lowlands, and mountain-meadow podsollic soils and mountain-wood soils predominate in the upper zone of the mountains.

The climate of the Apennine Peninsula for the most part is subtropical and Mediterranean. It is characterized by a mild, rainy winter and warm, dry summer. There is unstable weather with variable winds in spring. The mean temperature in January is 1-12° C and in July 23-28° C. The climate is transitional on the Po plain, from subtropical to temperate; the mean temperature in January is around 0° C and in July it is 22-24° C.

Freezing weather in the Alps in January goes to -15° C and even to -20° C. The snow line runs at an altitude of around 3,000 m. The majority of passes are blocked by snow and there are frequent snow avalanches and slides.

Precipitation falls in the form of rain and snow chiefly in spring and fall. Its annual amount reaches 600-800 mm.

**Population and state system.** Italy has an overall population of 57.2 million (as of mid-1986), of whom 49 percent are males. Urban residents make up approximately two-thirds of the country's entire population. The mean density is around 150 persons per square kilometer. The national make-up is homogeneous, with Italians numbering up to 98 percent. There are around 20.7 million persons among the gainfully employed population, of whom 7.4 million (36 percent) work in industry and construction, 5.5 million in the sphere of services, 4.1 million in trade, 2.5 million in agriculture, and 1.1 million in transportation and communications. Over two million persons are unemployed.

The state language is Italian and the overwhelming majority of believers are Catholics. The capital is Rome (2.9 million residents, and counting the suburbs over 3.7 million). Among the largest cities are Milan (1,705,000), Naples (1,224,000), Turin (1,191,000), Genoa (800,000), Palermo (673,000), Bologna (486,000), Florence (465,000), Catania (400,000), Venice (362,000), Verona

(262,000) and Trieste (246,000). Administratively, Italy consists of 20 regions divided into 94 provinces, and the provinces are divided into communes.

The head of the Republic is the President, elected at a joint session of both Houses of Parliament with the participation of regional representatives. His term of power is seven years. Legislative authority belongs to the Parliament, consisting of a Chamber of Deputies and a Senate. The 630 members of the Chamber of Deputies are elected by the population by universal suffrage according to a system of proportional representation. The Senate (322 persons) also is elected by universal suffrage under a mixed electoral system, including elements of majority and proportional systems. The term of power of both Houses is five years.

Executive power is exercised by the Council of Ministers, whose President is appointed by the President of the Republic. The Council President offers his proposals on the make-up of the government, which must receive approval of both Houses, and he swears in the President of the Republic.

The principal political parties are the following. *Italian Communist Party*, founded in 1921, is the largest organized political force in Italy (some 1.6 million members). It defends the interests of all workers. The central printed organ is the daily newspaper L'UNITA. The *Christian Democratic Party* (over 1.4 million), founded in 1943, reflects the interests of the monopolistic bourgeoisie and large landowners and is closely connected with the Vatican. The *Italian Socialist Party* (557,000, 1892) belongs to the Socialist International. The printed organ is the newspaper AVANTI!. The *Italian Socialist Movement-National Right* (382,000) is a neofascist party which was founded in 1947; its activity has stepped up in recent times. The *Italian Social Democrat Party* (over 200,000) was founded in 1948. The *Italian Liberal Party* (60,000, 1845) is right-bourgeois and represents the interests of conservative circles of the big bourgeoisie and landowners. The party of the petty and middle bourgeoisie, the *Italian Republican Party* (around 120,000), has been functioning since 1832.

**Natural resources.** Italy is poor in minerals, as a result of which its economy depends to a considerable extent on the import of raw materials. There are small deposits of molybdenum, mercury, zinc, lead, bauxite, sulphur, manganese, uranium ore and natural gas. There is a rather large amount of construction material (marble, granite, crushed stone) and considerable hydraulic power resources.

**Industry.** Italy is a highly developed industrial-agrarian country with a considerable military-industrial potential. It holds sixth place in the capitalist world after the United States, Japan, the FRG, Great Britain and France in volume of industrial production and degree of development of state-monopoly capital.

According to foreign press data, industry accounts for almost 43 percent of the national income, agriculture over 7 percent, and the sphere of services the rest. Machine building (above all motor vehicle building,

shipbuilding, precision machine building, electrical engineering, instrument making) is the leader in industry as well as such sectors as the chemical, metallurgical, oil refining, textile and food industry. The private companies of FIAT, Montedison, Pirelli, SNIA-Viscosa and others hold commanding positions in the economy. The state sector plays a significant role.

A high level of development of the economy and S&T achievements permitted developing the country's production of modern models of weapons and military equipment. Italy holds one of the first places in the capitalist world behind the United States and France in the export of arms. Over 300,000 persons are engaged in the military industry.

Production of small arms, artillery and ammunition is concentrated in the vicinity of the cities of Rome, Anania, Brescia and Piacenza; aircraft and missiles in Genoa, Naples, Calteferro (near Rome) and Gallarate; and other military equipment in Genoa, Turin and La Spezia. Over 80 large firms (the leading ones are Aeritalia, Agusta, SIAI-Marchetti, Piaggio) participate in producing aircraft and missile-space equipment. There are major shipyards in the seaports of Genoa, La Spezia, Livorno, Naples, Trieste, Monfalcone and Taranto.

The principal industrial centers are Milan, Turin and Genoa (four-fifths of the output of all machine building, three-fourths of ferrous metallurgy, 70 percent of chemical industry and 90 percent of the textile industry), Naples (metallurgy, shipbuilding, aircraft construction), Florence (instrument making and sectors of the chemical industry) and Rome (aircraft construction, transport machine building, manufacture of optical instruments). A characteristic feature of the development of Italian industry in recent years is the rapid growth of robotization of production processes.

Research in the field of nuclear physics is being done by scientific centers located in Casaccia and Frascati (near Rome), Selugga (near Turin), Rotondella (20 km north-east of Oriolo) and Bologna. The most important atomic electric power stations are in Latina (60 km south of Rome) and Trino-Vercellese.

In 1986 the country produced some 24 million tons of steel, 21 million tons of rolled products, over 0.35 million tons of aluminum ingots, 0.27 million tons of zinc ingots, over 1.7 million motor vehicles, 37 million tons of cement, 2.6 million tons of petroleum, 14.4 billion m<sup>3</sup> of natural gas and 190 billion kilowatt-hours of electrical energy.

In foreign trade (both import and export) the principal place is occupied by EEC countries, which account for over 50 percent of the foreign trade turnover. Italy exports machines and equipment, motor vehicles, ships, machine tools, petroleum products and citrus fruits and

imports petroleum, iron ore, coal, nonferrous metals, grain, cotton and wool. The FRG, France, United States and the Netherlands are its primary trading partners.

A typical feature of agriculture is its specific direction (basically grain growing—wheat and corn), and viticulture, horticulture and vegetable raising also are developed. Large capitalist farms predominate in the north, and small producers have remained in the south. The area of agricultural lands is over 17 million hectares. This sector of the economy is highly mechanized. The country's principal granary is the Po plain. The agricultural machinery pool exceeds three million pieces, of which 1.2 million are tractors.

In 1986 the harvest of the principal agricultural crops was as follows (in millions of tons): wheat 9.1, corn 8.4, rice 1.0, sugarbeets 13.1, potatoes 2.7, grapes 12.0 and citrus fruit 3.6. The number of cattle approaches 9.1 million head.

Italy's Armed Forces<sup>1</sup> consist of the Army, Air Force and Navy. In addition, there are Carabinieri troops and a Finance Guard. Overall strength is around 500,000 persons. The Army (primary branch of the Armed Forces) includes field troops and territorial defense troops. The western military press reports that the former comprise the basis of NATO's Allied Land Forces in the central part of the Southern European sector. The latter are intended chiefly for conducting combat operations in areas not part of the zone of responsibility of field troops. The Air Force has three air commands—Tactical, Transport and Training.

The Italian Air Force makes up the basis of NATO's 5th Allied Tactical Air Command. The Navy includes the fleet, naval aviation and marines. In addition, there is a command of frogmen and commandos.

The Carabinieri troops number 98,000 and the Finance Guard 38,000. On the whole, foreign military specialists believe that the Italian Armed Forces are outfitted with modern combat equipment and are the most combat-ready component of the NATO Allied Forces grouping on the southern flank of this bloc.

*Command and control facilities and communication equipment.* The headquarters of the NATO Supreme Command, Allied Forces Southern Europe (Naples), headquarters of Allied Land Forces Southern Europe (Verona), headquarters of the 5th Allied Tactical Air Command [ATAC] (Vicenza), and headquarters of the Naval Striking Forces Command and the Allied Naval Forces Command (Naples) are located on the territory of Italy.

Hardened underground command and control facilities have been prepared for command and control in wartime. The command and control facility of NATO's Supreme Commander Allied Forces Southern Europe is 50 km northwest of Naples, and that of the commander

of NATO's Allied Land Forces Southern Europe is near Verona. They have protection against nuclear weapons, self-contained sources of electrical power, and stores of food and water.

Command and control and communications of the above headquarters with the troops are carried out basically using the NATO Ace High Tropospheric Communications System, which represents a multichannel integrated network of radio relay and tropospheric stations, as well as over cable communication lines. Space communication stations in the cities of Brindisi, Coltano (near Livorno) and on Sigonella Air Base are used in the interests of the U.S. Armed Forces, and those in Aurella and Martina Franca in the interests of the NATO Allied Forces. Channels of the Intelsat system's commercial satellite communications are allocated for international communications; ground stations of this system are set up at Lario (80 km north of Milan) and Fucino (90 km east of Rome). Stations of the American DSCS global satellite communication system are situated at Lago di Patria (20 km west of Naples) and Coltano. They support communications for U.S. Armed Forces located in this region.

The route of the Mediterranean system of tropospheric and radio relay communications passes through the territory of Italy with offshoots to the FRG and through the island of Sardinia to Spain, which is used by the U.S. Armed Forces. In addition, the Pentagon deployed a major communications intelligence center near Brindisi.

Telephone and telegraph communications are developed in the country. Large automated centers of such communications are in the cities of Rome, Naples, Milan, Verona, Bologna, Turin, Venice and Bolzano. A U.S. Air Force medium range *cruise missile facility* is deployed on Sicily near Comiso. A complex of facilities for maintenance of missile equipment, shelters for launchers and missile launch control centers, a communications center, and service and auxiliary buildings is situated on its territory. There are 112 ground-launched cruise missiles stationed here. This facility is to be closed and the missiles themselves are to be destroyed in accordance with the INF Treaty signed between the USSR and United States.

The *airfield network* includes 125 airfields and landing strips with runways 500 m or more long. The size and class of equipment of approximately 50 of them permit receiving aircraft of combat and transport aviation.

Airfields intended for basing tactical aviation as a rule have one major runway 2,400 m long and 45 m wide, taxiways, group and single flight lines, ammunition and POL depots, and facilities and shelters for personnel and military equipment.

The principal airfields where aircraft are based are Aviano, Bari, Brindisi, Villafranca, Ghedi, Grazzanise, Grosseto, Guidonia (Rome), Gioia, Istrana (near

Treviso), Cameri, Catania, Latina, Milan, Naples, Pisa, Pratica di Mare (Rome), Rivolto (Udine), Rimini, Sigonella, San Giorgia, Treviso (San Angelo), Foggia, and Ciampino. Aviano Airfield is completely at the disposal of the U.S. Air Force and Sigonella at the disposal of U.S. Naval Aviation. Some of the above airfields are intended for supporting the basing of NATO Allied Air Forces. E-3A airborne early warning and control aircraft of the NATO AWACS command constantly use the forward operations base of Trapani (Birgi).

Measures taken to improve the airfield network include resurfacing runways and taxiways, expanding flight lines, constructing hangars, shelters and auxiliary buildings, and replacing obsolete radionavigation equipment. In the opinion of the NATO command, Italy's airfield network is capable of supporting the dispersed basing of the existing grouping of national and allied air forces and permits receiving aircraft for its reinforcement from other theaters.

*Naval bases and ports.* Eight naval bases have been built in Italy in support of combat training, day-to-day activities and deployment of naval forces—Taranto (main), Ancona, Augusta, Brindisi, Cagliari, Messina, Naples and La Spezia—as well as three naval basing facilities (Gaeta, La Maddalena, Santo Stefano). Work done in recent years to improve the basing conditions for naval forces included an increase in berthage, an expansion in ship repair capabilities, and installation of new material handling equipment.

Large, well equipped ports are located on the coast of the Adriatic Sea (Venice, Ravenna, Ancona, Bari) and the Tyrrhenian Sea (Savona, Genoa, La Spezia, Livorno, Fig. 4 [figure not reproduced], Gaeta, and Naples, Fig. 5 [figure not reproduced]). Convenient inlets and anchorages also can be used for dispersal of ships and vessels.

The Naples Naval Base is used as the main base of the U.S. Sixth Fleet. In addition, American ships call on the naval bases of Augusta, Cagliari and Brindisi and the port of Livorno.

According to views of foreign military specialists, in combination with natural shelters the established network of naval bases and ports is capable of supporting the dispersed basing and maneuver of the grouping of national and American naval forces in the Mediterranean basin.

*Air defense.* The territory of Italy is included in the Southern Zone of the NATO Allied Air Defense System in Europe and makes up the 5th ATAC air defense area. This area in turn is divided into two sectors, Northern and Southern. Air defense of the country's territory is provided by active and passive resources. Active resources include air defense fighter aviation, Nike-Hercules and Improved Hawk surface-to-air missiles, and army AAA.

SAM subunits situated at fixed positions cover the main grouping of troops, air bases and important military installations in the northern part of the country. Passive resources carry out detection, notification, and collection of data on the air situation and control the guidance of fighters and air defense weapons to the target.

The principal *military ranges* are set up on the island of Sardinia. A missile test range is on its east coast near Salto di Cuirra. Tests and practice launches of Nike-Hercules and Improved Hawk SAM, Lance missiles and antitank guided missiles are conducted here by units and subunits of armed forces of the FRG, United States, Norway, Denmark and other countries.

An air-to-ground range is situated on the west coast of the island 20 km southwest of Oristano and is used for training air force flight personnel of NATO countries in missile launches, bombing, and firing against ground targets. It has an area of 50 km<sup>2</sup>, and it also includes part of the water area of the Gulf of Oristano for the time of an exercise.

A range facility and training center have been set up for ground forces at the southern tip of the island on Cape Teulada. A military compound, depots, tank training area and other facilities have been built in an area of 100 km<sup>2</sup>. Problems of coordination among army subunits are worked and amphibious assault landings are carried out here. A territory of up to 300 km<sup>2</sup> is activated when an exercise is conducted. The range facility is used by subunits and units of armed forces of Italy as well as other NATO countries.

Great significance is attached to the development of **communication routes and transportation** as the most important elements of the economy and military infrastructure in Italy. Ground transportation routes are being developed and improved in accordance with national plans and with consideration of NATO requirements.

*Motor transportation* performs over 83 percent of domestic freight movements. A dense highway network has been created in the country, with their overall length reaching 300,000 km. Over 93 percent of the roads have a hard surface. There are almost 100 km of roads per 100 km<sup>2</sup> of territory. By subordination, highways are subdivided into state (45,500 km), provincial (97,000 km) and communal, and by technical characteristics they are subdivided into main highways and 1st, 2d and 3d class roads. The capacity of main highways is around 30,000 motor vehicles per day. First and second class roads have an asphalt concrete surface and roadway width of 6-8 m and their capacity is 3,000-5,000 motor vehicles per day.

At the present time around 6,000 km of high-speed main highways have been built, which together with 1st and 2d class roads make up over half of all highways. They are disposed unevenly, with the bulk of them in the north. The principal main highways run from north to south

along the Adriatic and Tyrrhenian seas. They link the largest cities of Northern Italy with cities of Reggio di Calabria and Bari in the south, and also serve as through routes to countries of Central Europe. Italy's border with contiguous states is intersected by 26 classified roads. Eight routes lead into France and six each into Switzerland, Austria and Yugoslavia. The motor vehicle inventory includes 22.4 million passenger vehicles, 1.8 million trucks as well as 38,000 buses and other equipment.

In the assessment of foreign specialists, on the whole Italy's highway network is sufficiently developed, it is in satisfactory technical condition, and in combination with railroads is capable of supporting the needs of the armed forces.

*Rail transportation* accounts for over 10 percent of all the country's freight movements. The length of railroads is around 20,000 km, of which over 10,000 km are electrified. Double-track lines extend almost 5,500 km. In railroad density (over 6 km per 100 km<sup>2</sup> of territory), Italy is behind such countries as the FRG, Belgium and France.

A large portion of the railroads run through valleys and in coastal areas. The route profile is rather complex. Over 40,000 bridges, tunnels and viaducts have been built on the railroads and there are some 1,000 railroad crossings. Train speeds reach 70-100 km/hr. The capacity of main railroads is up to 30 pairs and of double-track lines up to 70-90 pairs of trains per day. Italy is linked with France, Austria and Yugoslavia by 12 railroad routes.

The rolling stock of state railroads includes 2,100 electric locomotives, around 1,700 diesel locomotives, 112,000 freight cars and over 13,000 passenger cars. The rail network has over 2,200 stations, flag stations and sidings, but approximately 400 large stations account for 90 percent of the freight turnover and 225 other small stations for another 5 percent. Milan, Turin, Rome, Naples and Bologna are important rail centers.

The overall length of *navigable inland waterways* is approximately 1,400 km, of which over 330 km run along canals and the rest along rivers and lakes. Eight hundred kilometers of water routes are suitable for the navigation of vessels with a cargo capacity of up to 1,500 tons, and around 300 km of water routes for vessels with a cargo capacity over 1,500 tons. Vessel speed on the rivers is up to 15 km/hr, and on canals it is 8 km/hr. The principal inland waterways are in the northern provinces of Cremona, Mantua, Ferrara, Piacenza, Parma and others. They include the River Po and other rivers which carry their waters in a latitudinal direction, and the canals linking them. Water routes along lakes Lago Maggiore, Como and Garda are of local importance. Each year some 4 million tons of freight are carried over inland waterways.

*Maritime transportation.* One state company and some ten private companies control shipping in Italy. The country holds 13th place in the world (as of mid-1987) in merchant fleet tonnage. It accounts for around 2 percent of world fleet tonnage. The merchant fleet has some 1,600 vessels (gross tonnage of 100 register tons or more), including 875 vessels with a gross tonnage of 300 register tons or more. The cumulative cargo-carrying capacity of the latter is 11.9 million tons. These ships include 214 tankers (deadweight of 4.7 million tons), 307 vessels for general cargoes (1.2 million tons), 64 bulk carriers (3.1 million tons), 60 chemical tankers, 40 gas carriers, 18 combination vessels, 16 containerships, 150 ferries and so on. The vessels' average length of service is 13 years.

Italy has a total of some 100 seaports, which process up to 90 percent of the freight. Genoa, La Spezia, Trieste, Venice, Palermo and Livorno are considered the largest.

*Air transportation* is represented by the large Alitalia airline, which holds eighth place among similar associations of capitalist states, and by its subsidiary divisions, which make almost all intercontinental, 95 percent of European, and 85 percent of domestic movements. Alitalia makes flights on 50 international and over 70 domestic routes. The ATI company is second in importance, accounting for half of passenger movements on domestic routes.

The civil aviation inventory numbers 1,300 aircraft, including 100 with a take-off weight of 9 tons or more, and 160 helicopters.

*Military pipelines*<sup>2</sup> on Italian territory were built with consideration of NATO requirements. One of the main lines runs in a northeastern direction from the fuel off-loading point in the port of La Spezia to the U.S. air base at Aviano. Its capacity is up to 2,000 tons of fuel per day. An offshoot runs from this pipeline near the city of Parma to the city of Ravenna, situated on the Adriatic coast. Military petroleum products lines also have been built on the island of Sicily.

The Central European main petroleum line (Genoa-Ingolstadt, FRG; length 668 km; pipe diameter in the initial sector 660 mm) and the Trans-Alps line (Trieste-Ingolstadt, crossing Austria; length 464 km; pipe diameter 1,016 mm; capacity 39 million tons per year) have been built for pumping crude oil from Italian ports to oil refineries of other countries.

In addition to the main pipelines, several petroleum pipelines of local importance have been built. Their capacity depends on a number of factors and can reach 12 million tons per year. The overall length of petroleum pipelines in the country is 3,580 km.

In the assessment of foreign military specialists, Italy is an economically developed state that is well prepared in the military sense. The command authorities of national

armed forces and the NATO Allied Forces continue to attach great significance to development of the military infrastructure, especially those elements which directly create favorable conditions for deployment and conduct of combat operations by troops on the southern flank of the North Atlantic Alliance.

#### Footnotes

1. For more details on the Italian Armed Forces, Army, Air Force (5th ATAC) and Navy respectively see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 11, 1984, pp 13-17; No 5, 1987, pp 19-24; No 5, 1986, pp 33-37; and No 8, 1985, pp 61-67—Ed.

2. For more details on the principal petroleum pipelines see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 3, 1988, pp 70-73—Ed.

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#### U.S. Navy Ship Repair Base

18010378p Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 12, Dec 1988 (signed to press 7 Dec 88) pp 78-88

[Article by Capt 1st Rank (Res) M. Tsiporukha]

[Text] In recent years the U.S. Navy command has given special attention to developing the ship repair base and improving the ship repair system. This was because of the increased importance of ship and vessel repair as one of the principal elements in a set of measures for maintaining combat readiness of the Navy, which is the striking force of American imperialism; it was also because of the increased complexity and scope of repair work on ships built in recent decades that are outfitted with modern power plants, missile weapons, electronic systems, and automatic and remote control equipment. For example, labor-intensiveness of yard repair of a series U.S. Navy guided missile destroyer rose an average of fourfold (from 20,000 to 80,000 man-days) from the early 1970's up to the 1980's rose. Therefore, in the assessment of American specialists, ship repair yards are an essential part of the country's military-technical potential.

Eight operating and two mothballed state ship repair yards and three repair centers belonging to the Navy situated in the continental United States, Hawaiian Islands, and at American naval bases on the territory of foreign states—Yokosuka (Japan), Subic Bay (Philippines) and Apra (Guam, Table 1).

Table 1—State Ship Repair Yards and U.S. Navy Repair Centers

Location (State)	Repair Work Specializa- tion by Ship Types	Number of Dry Docks with Length, m			Number of Hoisting Cranes with Load-Lifting Capacity, tons		Number of Slips*/ Load- Lifting Capacity, tons	Number of Large Float- ing Docks
		100-150	150-250	250-350	10-30	30-75		
1	2	3	4	5	6	7	8	9
<b>Ship Repair Yards</b>								
<b>Atlantic coast</b>								
Portsmouth, New Hamp- shire	SSBN, SSN	2	1	-	5	1	-	1
Boston, Massachu- setts	Mothballed	2	2	1	15	5	1/1,200	-
Philadelphia, Pennsylvania	Carriers, cruisers, destroyers, frigates, die- sel-electric submarines	1	1	3	11	12	2/3,000	-
Norfolk, Vir- ginia	SSN, nuclear powered sur- face ships, carriers, cruisers, destroyers, frigates, sup- port vessels	4	1	2	11	5	-	-
Charleston, South Caro- lina	SSBN, SSN, carriers, cruisers, destroyers, frigates	2	3	-	7	3	-	-
<b>Pacific coast</b>								
Bremerton- Puget Sound, Washington	SSBN, SSN, nuclear pow- ered surface ships, carri- ers, cruisers, destroyers, frigates	-	2	4	15	3	-	-
San Fran- cisco- Hunters Point, Cali- fornia	Mothballed	3	1	2	-	16	1/50	-
Vallejo-Mare Island, Cali- fornia	SSBN, SSN, nuclear pow- ered surface ship, diesel- electric sub- marines	2	2	-	10	6	-	-
Long Beach, California	Carriers, cruisers, destroyers, frigates	-	2	1	3	3	-	-

Table 1—State Ship Repair Yards and U.S. Navy Repair Centers

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		100-150	150-250	250-350	10-30	30-75		
1	2	3	4	5	6	7	8	9
Hawaiian Islands								
Pearl Harbor	SSN, cruis- ers, destroy- ers, frigates	1	-	3	17	5	1/2,500; 1/ 3,000	-
Repair Centers								
Yokosuka (Honshu Island, Japan)	Carriers, cruisers, destroyers, frigates, sup- port vessels	3	1	2	-	-	-	-
Subic Bay (Luzon Island, the Philippines)	Repair work on surface ships of all principal types	-	-	-	-	-	-	5
Apra (Guam, Mariana Islands)	Repair work on ships and submarines of all princi- pal types	-	-	-	-	-	-	3

\*In addition to those in the table, there are slips at the following naval bases: Annapolis, Maryland (load-lifting capacity 175 tons), New London, Connecticut (3,000 tons), Quonset Point, Rhode Island (25 tons) and Washington, D.C. (500 tons).

In addition, the U.S. Navy has a number of ship repair yards of lesser size that are directly part of naval bases in the continental United States, including a U.S. Coast Guard yard in Seattle, Washington with 1,000 employees. And finally, ship repair subunits of tenders and repair ships, of which there are more than 30 in the U.S. Navy, are an important element of the above complex.

The work of repairing, modernizing and refitting U.S. Navy ships and vessels at operating state ship repair yards in the latter half of the 1980's has been valued at almost \$3 billion. The cost of facilities and equipment of these yards exceeds \$8 billion. There are 6,000-11,000 persons working at each yard. In 1986 there was a total of 71,000 persons employed at eight state ship repair yards.

Production personnel aboard U.S. Navy tenders and repair ships and at coastal ship repair enterprises of naval bases numbered over 25,000 workers and employees.

In addition to state enterprises, private firms also engage in ship repair. The primary volume of repair in the private sector is performed at 23 leading U.S. shipyards and 18 main repair yards (Table 2). According to the Maritime Administration classification, yards which have at least one shipbuilding position for forming a hull 145 m long and 20.7 m in beam are categorized as leading yards. In addition, there are over 150 small private ship repair yards with limited technical capabilities.



Table 2 - Private U.S. Ship Repair Yards

Location (State)	Principal Companies and Their Yards Engaged in Ship Repair	Specializa- tion of Repair Work by Ship Types	Number of Dry Docks, with Length,			Number of Floating Docks with Length, m		Number of Synchro- lifts with Load- Lifting Capacity over 3,000 Tons
			100-200	200-300	Over 300	100-200	200-300	
1	2	3	4	5	6	7	8	9
Atlantic coast								
Bath, Maine	Bath Iron Works	-	-	-	-	1	-	-
Portland, Maine	Bath Iron Works	-	-	-	1	-	1	-
Boston, Massachu- setts	Bethlehem Steel	-	1	-	1	2	-	-
Groton, Connecticut	General Dynamics, Electric Boat Division	SSBN, SSN	1	1	-	1	-	-
Quincy, Massachu- setts	General Dynamics, Quincy Ship- building Division	SSBN, SSN, supply trans- ports	-	3	-	1	-	-
Brooklyn, New York	Todd Ship- yards	-	4	3	2	7	-	-
Hoboken, New Jersey	Bethlehem Steel	-	-	-	1	3	1	-
Chester, Pennsylva- nia		-	-	-	-	-	2	-
Baltimore, Maryland	Maryland Shipbuilding and Dry Dock, Beth- lehem Steel	-	2	-	-	2	4	-
Newport News, Vir- ginia	Newport News Ship- building and Dry Dock	SSBN, carri- ers	2	2	2	1	-	-
Portsmouth, Virginia		-	3	1	2	-	-	-
Norfolk, Vir- ginia		-	-	-	-	1	1	-
Charleston, South Caro- lina		-	-	-	-	2	-	-
Savannah, Georgia		-	1	-	-	-	-	-
Great Lakes Ports		-	3	5	2	2	-	1
Florida Coast and Gulf of Mexico								

Table 2 - Private U.S. Ship Repair Yards

Location (State)	Principal Companies and Their Yards Engaged in Ship Repair	Specialization of Repair Work by Ship Types	Number of Dry Docks, with Length,			Number of Floating Docks with Length, m		Number of Synchronizers with Load-Lifting Capacity over 3,000 Tons
			100-200	200-300	Over 300	100-200	200-300	
Jacksonville, Florida		-	-	-	-	6	1	-
Everglades, Florida		-	-	-	-	-	-	1
Tampa, Florida		-	1	1	-	-	-	-
Mobile, Alabama		-	-	1	-	3	1	-
Pascagoula, Mississippi	Litton Industries, Ingalls Shipbuilding Division	SSN, support vessels	1	-	-	-	1	-
New Orleans, Louisiana	Todd Shipyards, Avondale Shipyard	-	-	-	-	2	2	-
Orange, Texas		-	-	-	-	2	-	-
Beaumont, Texas	Bethlehem Steel	-	-	-	-	1	-	-
Houston, Texas	Todd Shipyards	-	-	-	-	1	-	-
Galveston, Texas	Todd Shipyards	Surface ships with nuclear power plants	-	-	-	1	1	1
Pacific coast Seattle, Washington	Todd Shipyards, Lockheed Shipbuilding and Construction	Cruisers, destroyers, frigates	-	-	-	7	-	-
Portland, Oregon		-	-	-	-	2	2	-
Richmond, California		-	4	1	-	-	-	-
Oakland, California		-	-	-	-	1	-	-
San Francisco, California	Todd Shipyards, Bethlehem Steel, Southwest Marine	Cruisers, destroyers, frigates, large landing ships	3	1	2	2	2	-
Los Angeles, California	Todd Shipyards, Southwest Marine (San Pedro)	Destroyers, frigates, patrol ships	-	-	-	2	2	1
San Diego, California	National Steel and Shipbuilding, Southwest Marine	Destroyers, frigates, patrol ships	-	1	-	3	1	-

The predominant role among the leading private yards in repairing large ships and vessels is played by 12 yards which the U.S. Navy command considers the foundation of the shipbuilding sector's military-industrial potential. In the mid-1980's private yards of the shipbuilding industry had almost 50 construction and 100 repair dry docks and a considerable number (up to 150) of floating docks.

According to information as of the mid-1980's, 30,000 of the 115,000 persons working in the private sector of this branch of U.S. industry were engaged in repairing and modernizing U.S. Navy ships and vessels.

Moreover, private yards where SSBN's are built each year send groups of their specialists (up to 200) to forward SSBN basing facilities in the European theater (such as Holy Loch in the UK), where they are used to support scheduled repair work.

At the same time, it cannot be forgotten that private U.S. shipyards and ship repair yards considerably surpass state ship repair yards in their potential capabilities and are a large-capacity reserve capable of sharply increasing their load in support of Navy requirements for repairing, modernizing and refitting ships and vessels. This is attested by the experience of using private yards in the period of World War II and the aggressive wars in Korea and Vietnam.

Inasmuch as the importance of ship repair plays a significant role in the set of measures for maintaining Navy combat readiness, over the last ten years the proportion of funds allocated for repair, modernization and refitting (with the exception of major modernization work such as refitting SSBN's with new missiles, for which there are separate specific appropriations) reached 30-35 percent of shipbuilding appropriations. For example, during fiscal years 1976-1985 expenditures for repair, modernization and refitting of ships exceeded \$25 billion.

From the beginning of the 1970's, after the U.S. Congress made the decision to stop building new ships at naval ship repair yards (these functions were transferred to private firms), the primary mission of such yards has been to repair and modernize ships and vessels. In recent years state ship repair yards have accounted for up to 70 percent of the overall cost volume of repair and modernization work. The other 30 percent of the work has been performed by private yards, where their cost was approximately a third lower. For example, in 1984 private yards performed even 34 percent of the overall volume of work

of repairing naval ships (when the repair of ships with nuclear power plants is excluded, private yards performed 60 percent of all work).

The U.S. Navy command organized the interworking of its ship repair yards with private repair yards. In a number of cases naval yards perform the fitting-out of ships constructed at private yards, install individual electronic systems on them, and conduct comprehensive trials before the ships are commissioned. All ship repair yards and major private shipyards specialize in the repair and maintenance of ships of specific types (see tables 1 and 2).

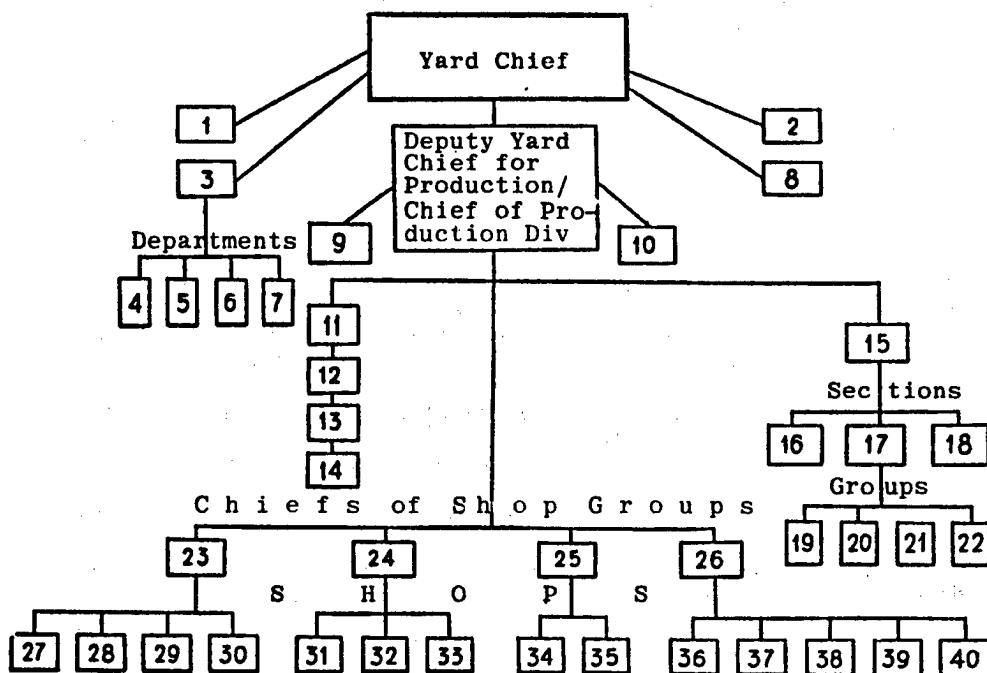
To support the Navy's growing requirements for repair and modernization work, considerable attention is being given to the modernization of state ship repair yards. For example, according to the modernization program adopted for 1965-1979, \$0.5 billion were spent even before 1976 for constructing new shops, docks and fitting-out berths at these yards, for expanding existing facilities, and for purchasing and installing new production equipment. There were \$314 million spent to construct production facilities and \$182 million to purchase equipment (including machine tools with numerical control for machining, equipment for airless cleaning and painting of sheet steel and structural shapes, oxyacetylene cutting and welding equipment with numerical control, and so on).

In FY 1977, even before the end of the above program's effective period, the decision was made to conduct significant new work of modernizing state ship repair yards during fiscal years 1977-1986. A total of some \$1.4 billion were spent for these purposes for the given period just by the eight operating yards, of which over \$220 million went to purchase new production equipment.

From the early 1970's all state ship repair yards shifted to a unified organizational structure under which production shops fall under the deputy yard chief for production/production division chief and are consolidated in a single production division. The shops of this division are broken into four groups. A type structure of a U.S. Navy state ship repair yard is shown in the diagram.

At the present time the Shipyard MIS unified management automation system is functioning at all ship repair yards. The structure of the management automation system and what it encompasses are shown in Table 3. Management automation system documentation consists of references for each subsystem containing samples of all record and account forms and describing in detail the input and output data, codes, and technological processes of data processing and output.

Type structure of U.S. Navy state ship repair yard



Key:

- |   |  |
|---|--|
| 1. Personnel department   | 21. Electrical engineering and radio engineering         |
| 2. Finance department   | 22. Maintenance  |
| 3. Deputy yard chief for planning                               | 23. Hull   |
| 4. Chief designer   | 24. Mechanical   |
| 5. Planning-production  | 25. Electrical equipment and electronics                 |
| 6. Armament work  | 26. Maintenance  |
| 7. Logistics  | 27. Hull   |
| 8. Legal advice   | 28. Machining  |
| 9. Assistant for administrative affairs                         | 29. Welding  |
| 10. Safety consultant   | 30. Boiler   |
| 11. Chief builder   | 31. Main ship power plant machinery and equipment repair |
| 12. Assistant chief builder                                     | 32. Deck machinery repair                                |
| 13. Senior builder  | 33. Turbine copper-plating                               |
| 14. Builder   | 34. Electrical equipment                                 |
| 15. Chief of production organization department                 | 35. Electronic repair                                    |
| 16. Equipment and tool repair control                           | 36. Tool   |
| 17. Improvement of production methods, equipment and facilities | 37. Woodworking  |
| 18. Improvement of nuclear power plant maintenance              | 38. Painting   |
| 19. Hull  | 39. Rigging  |
| 20. Mechanical  | 40. Auxiliary work                                       |

**Table 3—Structure of U.S. Navy Ship Repair Yard Management Automation System and What It Encompasses**

Classification Number	Subsystems and What They Encompass	Number of Record and Account Forms
1.0	Finances	
1.1	Calculating expenditures for each repair job	110
1.2	Compiling estimates for determining overhead expenses	7
1.3	Monitoring payment of suppliers' accounts and checking correctness of their submission; calculating wages, monitoring compliance with labor legislation regarding wages	80
1.4	Monitoring payment of accounts and payment demands by clients, checking correctness of their compilation	40
2.0	Production	
2.1	Calculating labor-intensiveness of planned jobs, calculating available shop capacity based on labor resources, comparing it with the plan*	20
2.2	Calculating repair network schedules, ensuring the functioning of the network planning and management system	25
2.3	Providing information on job status, comparing planned and actual labor inputs in man-hours	20
2.4	Monitoring job quality	15
2.5	Accounting for development and output of technical documentation (drawings and specifications for parts and materials)	12
3.0	Logistics	
3.1	Accounting for receipts at the yard and expenditure of materials and set-completing articles	45
3.2	Accounting for shop reserves of materials and parts	20
4.0	Personnel, fixed capital, and check of execution	
4.1	Keeping personal account cards on servicemen and civilian workers, determining labor force requirements	15
4.2	Monitoring personnel's cumulative exposure to radioactive irradiation	4
4.3	Monitoring the purchase, write-off, or change in value of the yard's power, production and transportation equipment	20
4.4	Accounting for and monitoring repair and modernization of yard's power, production and transportation equipment	15
4.5	Preparing reports to higher echelons and monitoring execution	

\*The management automation system uses a special modeling device which permits evaluating the effect of yard leaders' decisions on a change in job schedules and in shop workload plans for timely ship repair.

The management automation system constantly provides all levels of the ship repair yard leadership with current information on inputs for performing particular jobs, on the financial condition of the yard and its subunits, as well as current information on the status of production. The system permits establishing different periods for putting out information (daily, once a week and so on) and monitoring the timeliness of its receipt.

Use of the management automation system largely improved the quality of production management and effectiveness of the work as a whole. The system was constantly improved throughout the 1970's and the first half of the 1980's. At the present time thanks to its use yard leaders can efficiently assess the influence of a redistribution of labor and material resources for fulfilling the work plan; perform an automated calculation of expenditures and labor-intensiveness; and maintain continuous monitoring over receipt and expenditure of materials.

Despite the increasing workload on ship repair yards, the Navy command is attempting to reduce the number of operating yards through labor intensification and the use of new technological equipment. Because of this alone the number of workers at ship repair yards was reduced by 8,000 persons during 1984-1986 without a decrease in the product output plan.

Considering the importance of developing the shipbuilding and ship repair sector as an essential element of the country's military-economic potential, since the late 1970's the United States has continued to expand and modernize private yards through a system of state orders, subsidies and benefits on which several hundred million dollars are spent annually.

U.S. Navy orders for repair and modernization of ships basically are placed with major private yards. Above all these are yards of the **Electric Boat Division** (Groton,

Connecticut) and **Quincy Shipbuilding Division** (Quincy, Massachusetts) of the **General Dynamics Corporation**. They build SSBN's and SSN's, and the yards have gained extensive experience in their repair and modernization. In the latter half of the 1970's considerable new production capacities were placed in operation at the yard in Groton, for which over \$280 million were spent. Series construction of Trident system SSBN's has been carried on here since 1976.

The yard of **Newport News Shipbuilding and Dry Dock** (Newport News, Virginia) is one of the largest shipbuilding and ship repair yards in the world. It builds and repairs SSBN's and surface ships of all types with nuclear and conventional power plants. The number of persons employed exceeds 20,000.

Adoption of a five-year program for modernizing the yard was announced back in 1981. Some \$400 million were assimilated during the past period in rebuilding a number of sectors of the yard. It has one of the world's largest dry docks, 490 m long, equipped with a gantry crane with a load-lifting capacity of 900 tons. This dock previously was intended for building large gas carriers, and under a modernization program it was adapted for building "Nimitz"-Class carriers with nuclear power plants. The hull assembly production was expanded substantially, the principal part of the job of saturating hull block-sections was shifted to covered spaces, and the use of oxyacetylene cutting and welding equipment with NC was expanded. Two 200-ton transporters and a powerful prime mover for transporting block-sections, and two 30-ton rotary cranes (one such crane and one with a 60-ton load-lifting capacity were previously installed at the yard) were additionally acquired.

Two wooden fitting-out piers were replaced with reinforced concrete piers. A new repair dock for SSBN's costing \$28 million was operational as early as 1981, which doubled the yard's capacity for repairing and recharging their nuclear reactors. An old repair dock was modernized, which cost \$15 million. Twenty million dollars were spent for modernizing the North Yard sector of the yard to support the capability of repairing aircraft carriers there.

In August 1983 the company announced a plan for creating a production complex costing \$300 million for series construction of "Los Angeles"-Class SSN's and for performing all kinds of their repair.

The new complex consists of a four-bay shop building for modular assembly of SSN hulls with an overall area of 11,150 m<sup>2</sup>.

There are provisions for four shipbuilding positions where four SSN's can be built simultaneously. A transfer dock has been accepted as a launching facility in which a constructed submarine is moved and becomes waterborne when the docking chamber is flooded.

The new complex includes a floating repair dock 183 m long and a gantry crane with a load-lifting capacity of 900 tons. Placing the floating repair dock in operation permitted doubling the volume of SSN repair work being done by the yard. The company bought a metal-working plant in Arden, North Carolina in early 1981 to support an increased volume of shipbuilding and ship repair.

The two yards of the **Ingalls Shipbuilding Division** of the **Litton Industries** concern in Pascagoula, Mississippi are the largest private shipbuilding and ship repair yards. The old yard, called the East Yard, specializes in building and repairing SSN's and auxiliary vessels of the Navy. It has a dry dock for vessels up to 146x21 m in size. The new yard, West Yard, is intended for large-series construction of ships and vessels.

One other large private company engaged in ship repair is the **Bath Iron Works** in the city of Bath, Maine. The ship repair equipment at its yards has been renovated for over \$60 million. The company spent up to \$50 million building a new yard for civilian and military ship repair in the city of Portland, Maine, where 1,000 persons are employed. A floating dock with a load-lifting capacity of 24,000 tons also has been placed in operation there. In addition to ship repair, the yard performs fitting-out work on vessels which have been launched in the city of Bath, where the company has a floating dock with a load-lifting capacity of 8,000 tons.

One of the largest shipbuilding and ship repair corporations, **Todd Shipyards**, invested considerable funds to modernize production. The construction and introduction of a floating dock with a load-lifting capacity of 40,000 tons, as well as modernization of a fitting-out berth and cranes at the yard in Galveston, Texas cost the corporation \$40 million. Twelve million dollars were spent constructing a new dock with a load-lifting capacity of 14,000 tons and placing it in operation at this company's yard in Houston, Texas. Equipment also is being modernized at the company's yard in Brooklyn, New York.

It cost Todd Shipyards \$40 million to build the world's largest Synchrolift ship lift at the yard in Los Angeles, California. The lifting platform of the Synchrolift is 200x33 m in size. It is possible to lift a ship with a deadweight of up to 48,000 tons on it. The company spent another \$60 million renovating three repair yards in San Francisco. According to American press reports, it spent \$20 million to build fitting-out berths at the yard in Seattle, Washington and \$15 million for building a new dock and expanding fitting-out berths at the yard in New Orleans, Louisiana. There is a total of 19 floating docks with a load-lifting capacity of from 5,700 to 33,000 tons and several dry docks at the corporation's nine yards.

The yard in Galveston was the repair facility for the vessel "Savannah" (world's only commercial dry-cargo ship with a nuclear power plant) for the entire period of

her operation. It has equipment for repairing, maintaining and recharging the cores of ship nuclear reactors, and yard specialists gained necessary experience in servicing vessels with nuclear power plants.

In addition to Todd Shipyards, the well-known company of **Lockheed Shipbuilding and Construction** (yard in Seattle) engages in ship repair (along with shipbuilding) on the Pacific coast.

The **Bethlehem Steel Corporation** is one of the largest shipbuilding and ship repair associations in the United States. Its yards are located in the cities of Boston, Massachusetts; Hoboken, New Jersey; Baltimore and Sparrows Point, Maryland; Beaumont, Texas; and San Francisco, California; and its own steel mill is on Staten Island, New York. This association has 17 floating docks (load-lifting capacity up to 65,000 tons) and nine dry docks.

The company of **Avondale Shipyard** also is modernizing production. Its yards are in New Orleans. A floating dock with a load-lifting capacity of 23,000 tons was placed in operation there and corresponding production capacities were created in the early 1980's, on which over \$40 million were spent.

At the yard of the **National Steel and Shipbuilding Company** in San Diego, California the volume of ship repair work in the mid-1980's exceeded 30 percent of the overall workload and continues to grow. In December 1982 the yard acquired a floating dock with a load-lifting capacity of 25,000 tons and it modernized repair berths, cranes and production equipment in the shops. At the present time the bulk of ship repair work at the yard is performed on U.S. Navy ships and vessels, while civilian ship repair plays a secondary role. Ordinarily Navy orders are rather considerable and are valued at \$5-20 million.

The **Southwest Marine Company**, which engages exclusively in ship repair, was founded in 1976. It has three ship repair yards located in the cities of San Diego, San Francisco and San Pedro (near Los Angeles). In addition, it has a small yard which was placed in operation in early 1985 on one of the Samoan Islands in the Pacific for repairing tuna boats not far from the fishery.

The yard in San Diego is this company's largest industrial enterprise. There were \$60 million allocated for its development. A new floating dock with a load-lifting capacity of 22,500 tons was acquired and is being used for docking naval ships based at San Diego Naval Base (in addition to carriers and large landing ships). In addition, the yard's modernization plan provided for building a berth 183 m long, new shops, and a system for moving ships and vessels from the floating dock onto the building ways. Up to 80 percent of ship repair work done at the yard is under Navy orders.

Seventy percent of the orders at the San Francisco yard involve the repair of escort ships (cruisers, destroyers, frigates) and Coast Guard ships.

The yard in San Pedro has a floating dock and berth 457 m long, to which ships with a draft up to 10 m can moor. This yard primarily fills Navy orders.

At the present time Southwest Marine yards are mastering the repair and docking of large landing ships, including dock landing ships.

In recent years there has been a considerable development of private repair yards on the Atlantic coast, especially in the Gulf of Mexico, which are constantly engaged in repairing ocean development equipment (floating drilling vessels, supply vessels and so on). The rather constant workload in the ship repair sector as well as tax benefits granted by the federal government provide an opportunity to replace the production and technological facility at those yards.

EMI, which was founded in Miami, Florida in the late 1960's and set up the country's largest technical service for maintaining ship engines, is the leading company for repairing ship diesels and supplying spare parts, tools and accessories for them.

In the mid-1980's over 200 private firms were engaged in ship repair in the United States and 71 yards had the capability of docking vessels longer than 90 m. In this period the repair of Navy ships and auxiliary vessels accounted for 50-55 percent of the total volume of repair work being done by private firms and amounted to \$2.1-2.8 billion per year.

The Navy command and owners of private companies give special attention to improving labor productivity and the quality of performing shipbuilding and ship repair work. A significant role in solving these problems is set aside for the work of so-called quality circles, which appeared in the 1960's in Japan and quickly spread to the enterprises of over 1,000 American companies belonging to various sectors of the economy.

Such quality circles were established for the first time in the ship repair and shipbuilding sector at the Navy's Norfolk Naval Shipyard (Norfolk, Virginia). First among the leading private firms to organize them for itself were Newport News Shipbuilding and Dry Dock (Newport News), Lockheed Shipbuilding and Construction (Seattle) and National Steel and Shipbuilding (San Diego). According to data as of mid-1983, there were some 60 quality circles at the Navy yard in Norfolk, up to 10 at the yard in Newport News, and up to 35 in yards belonging to those firms in Seattle and San Diego respectively.

Quality circles represent small groups of engineering-technical workers and other employees who gather together regularly once a week for an hour to identify,

analyze and solve specific production problems arising in their subunits. All decisions are promptly introduced to production. If the fate of a particular suggestion depends on a higher management level, the latter reacts immediately, supporting the initiative coming from below in every way.

The American press cites data to the effect that profit on invested capital resulting from the activity of such circles at private yards is from 400 to 1,000 percent in a period of from one to two years. Special studies conducted for the U.S. Navy showed that the activity of such circles at four state enterprises provided a 12 percent increase in labor productivity and at one large private yard a 6 percent increase over 3-4 months.

It is believed that in addition to a direct reduction of inputs for production, no less important a result of the quality circles' work was an increase in the role of the human factor in production, improved relations in production subunits, and an improvement in the decision-making process. Greater satisfaction with work and better relations with the management staff are seen in workers of subunits where quality circles are functioning. The majority of American shipbuilding companies made decisions back in 1983 to increase the number of such circles. Foreign specialists believe that the work of quality circles can become one of the important factors which will permit cutting the lag of American yards behind Japanese and South Korean yards in labor productivity approximately in half.

Special attention in improving ship repair production in the United States is given to introducing nondestructive diagnostic systems. It is believed that their active use in the period of prerepair identification of defects and in checking repair quality will permit significantly reducing the volume and cost of ship repair work.

Vibration and noise inspection of the condition of ship machinery and arrangements using computers for continuous or periodic registration and comparative analysis of vibroacoustic and thermal engineering characteristics has become widespread in the U.S. Navy. The following are widely used in systems for technical diagnosis and inspection of the condition of various machine units: individual sensors for continuous inspection of the amount of clearances in centers of friction; instruments for inspecting the deformation of parts and crack formation which use the acoustic emission effect; ferrographic methods for inspecting the condition of machinery based on a measurement of the content of products of wear of rubbing parts in lubricating oils; and optical defectoscopes for visual inspection of inaccessible assemblies and internal cavities of mechanisms using fiber-optic equipment.

At ship repair yards these means of nondestructive diagnostics and inspection are included in the make-up of numerous automated diagnostic benches and laboratories being manufactured both in a fixed version and in the form of portable and mobile units.

For example, during the 1984 sea trials of the dock landing ship "Whidbey Island," built at the Lockheed Shipbuilding and Construction Company yard, a special laboratory created by the firm of DLI Engineering was used for measuring vibrations. The objective of the trials was to determine vibration characteristics of the main machinery and shafting, basic hull elements, and mast and antenna array constructions. The laboratory was used to collect and centrally record data from more than 70 sensors installed on the ship. Enormously less time was spent recording vibration characteristics, including 1,500 combinations of the layout of sensors and testing conditions, than for recording the very same parameters in the ordinary way using individual sensors without remote data transmission to the memory unit. It is noteworthy that the trials took place in a moderate gale, which did not affect the gear's functioning.

It should also be noted that, as in shipbuilding, a stable trend toward a maximum transfer of jobs into enclosed spaces to preclude the effect of unfavorable weather conditions has been seen in ship repair in recent years. To this end U.S. ship repair yards are making wider and wider use of protective facilities for repair dry docks. The press has announced that as early as 1982 work concluded at the Bangor, Washington SSBN base to build two overhead steel structures weighing approximately 250 tons each for a repair dry dock. Each of the structures covering the dock is 30.5 m long and 13.7 m high with a span of 33.5 m, is installed on four electrically driven trolleys, and is capable of moving on rails along the 230 m dock at a speed of 27 m/min.

U.S. ship repair enterprises presently perform annual work worth \$5-6 billion (in 1982 prices). There are great opportunities to build up production volumes by converting the yards to two- or three-shift work and placing the mothballed capacities in operation.

Statistics show that with a large volume of refitting and modernization work, the length of yard repair of an SSBN, SSN and carrier is 18-24 months; for an SSN and carrier without a significant volume of refitting work it is 10-14 and 9-12 months respectively; for a cruiser, guided missile destroyer and guided missile frigate it is 6-10 months; and for a destroyer and patrol ship it is 3-4 months.

Ordinarily state ship repair yards are simultaneously performing repair and modernization on one SSN or one carrier; in addition, one or two SSN's and 2-5 escort ships (cruisers, destroyers, frigates) are undergoing repair not requiring serious refitting.

As a rule, two SSBN's are being repaired and modernized simultaneously at major private yards (in the cities of Groton, Newport News and Pascagoula), and another one or two SSN's are in yard repair without refitting. Two to five escort ships and large landing ships are undergoing repair simultaneously at each of the other private enterprises with Navy contracts.



American specialists believe that present ship repair capacities support yard repair of the Navy's existing ship make-up with consideration of the periods between repairs established in the U.S. Navy.

The constant efforts to build up and modernize the ship repair base attest to the desire of the U.S. Navy command to fulfill the behest of the military-industrial complex to keep combatant ships and auxiliary vessels, which are the striking force of American imperialism, in a high state of readiness.

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**NATO 'On-Call' Naval Force Mediterranean**  
*18010378q Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 12, Dec 1988 (signed to press 7 Dec 88) p 89*

[Article by Capt 2d Rank Yu. Kryukov]

[Text] The NATO military-political leadership is giving heightened attention to practicing actions by crews of combatant ships and aircraft of naval aviation of NATO countries as part of multinational forces formed on a permanent basis (NATO Standing Naval Force Atlantic, NATO Standing Naval Force Channel (Mine Counter Measures)) and for a period of exercises.

At the present time a standing NATO naval task force has not been created in the Southern European sector, and so the NATO "On-Call" Naval Force is assigned to accomplish tasks of exerting political pressure on individual countries in case a tense situation arises; three days are given for its formation, according to foreign press data.

The decision to create such a force was made by the NATO military-political leadership in 1969. It was formed for the first time in April 1970 in the vicinity of the Italian Augusta Naval base (island of Sicily). It includes destroyer/frigate types of combatant ships of bloc Mediterranean countries as well as of the British Royal Navy and U.S. Navy.

Traditionally ship operations are practiced as part of the force twice a year in the course of exercises codenamed Deterrent Force.

Overall leadership of the exercise is the responsibility of the Commander NATO Allied Naval Forces Southern Europe, and immediate direction of the force at sea is the responsibility of one of the naval force commanders of member countries. During the exercise ship crews practice tactical procedures of sailing in company, employing weapons and equipment during combat operations against surface combatants, hunting and killing submarines, and conducting antiaircraft and antimissile defense. The combat training program of the force also provides for conducting practice firings.

Recently the NATO command has been taking steps to expand missions assigned to the force together with other NATO naval forces outside the Mediterranean. In 1987 the "On-Call" Force took part in Exercise Open Gate-87 for the first time together with the NATO Standing Naval Force Atlantic. During the exercise combatant ships of the force accomplished missions of protecting ocean and sea lines of communication on NATO's southern flank. They received a convoy from the NATO Standing Naval Force Atlantic on western approaches to the Strait of Gibraltar and provided for its escort through the strait to the east under conditions of opposition by "enemy" surface combatants, submarines and aircraft. Western military specialists assume that the force's participation in operational combat training measures outside the Mediterranean basin will be on a permanent basis.

In attempting to expand capabilities of monitoring the situation in the Mediterranean, NATO bloc leading circles are nurturing the idea of establishing a NATO standing naval task force in the Mediterranean on the basis of the "On-Call" Force.

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**Italian-Brazilian AMX Fighter**  
*18010378r Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 12, Dec 1988 (signed to press 7 Dec 88) pp 89-90*

[Article by Col I. Karenin]

[Text] According to foreign press reports, the first series AMX fighter created jointly by the Italian firms of Aeritalia and Aermacchi and the Brazilian firm of Embraer has become operational with the Italian Air Force. Delivery of these aircraft to Brazil will begin in 1989. A total of 238 fighters (187 single-seat and 51 two-seat) were ordered for the Italian Air Force to replace obsolete G.91 and F-104 Starfighter aircraft, and 79 for the Brazilian Air Force (65 single-seat and 14 two-seat) to supplement EMB-326 attack aircraft.

The AMX fighter (designated the A-1 in the Brazilian Air Force) is intended chiefly for close air support of ground troops, interdiction and reconnaissance. It is a monoplane with a swept shoulder wing, single-fin tail unit and tricycle landing gear (see color insert [color insert not reproduced]). The power plant consists of one British-developed Spey Mk 807 turbofan with a maximum thrust of 5,000 kg-force. Fuel is accommodated in a fuselage tank and two integral wing tanks, as well as in auxiliary underwing tanks. Built-in armament includes one 20-mm Vulcan six-barrel cannon with a unit of fire of 350 rounds (on Italian aircraft) or two DEFA 30-mm cannon with a unit of fire of 125 rounds each (on Brazilian aircraft). Suspended armament (guided missiles and free-flight rockets, bombs of various calibers

and types) is accommodated on an underfuselage attachment point and on four underwing attachment points. In addition, attachment points at the wingtips are intended for Sidewinder air-to-air missiles. Principal characteristics of the AMX fighter are given below.

Crew	1
Weight, kg	
Maximum take-off	12,500
Empty aircraft	6,700
Maximum combat load	3,800
Maximum flight speed, Mach	0.9
Service ceiling, m	13,000
Ferry range, km	3,100
Combat radius (depending on combat load and flight profile), km	370-520
Length, m	13.57
Height, m	4.57
Wingspan, m	8.87
Wing area, m <sup>2</sup>	21

At the present time the Italian-Brazilian consortium producing the AMX intends to develop several new versions of this aircraft, including for delivering strikes against surface ships, conducting combat operations under nighttime conditions, and subsequently a specialized version for hunting and destroying radio-frequency-emitting targets.

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